VOLUME ONE/NUMBER FOUR/ $150 PM451

vertex

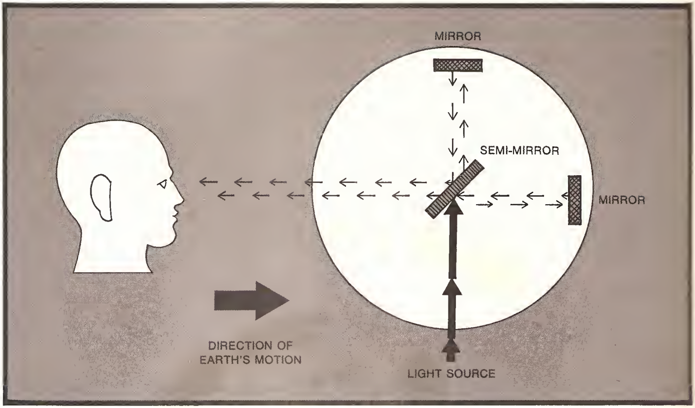
THE MAGAZINE OF SCIENCE FICTION

GEOTHERMAL POWER—Mother Nature's Home Remedy For The Energy Crisis

Vertex Interviews
FRANK HERBERT
Author of DUNE and
DUNE MESSIAH

The Myth Becomes
Reality—
ATLANTIS EXISTS!

Life in Space
Examined in
Twin Articles by
JAMES and
GREGORY
BENFORD



THE EXPERIMENT THAT FAILED

Everyone knows, and it has been known for quite some time, that sound will not travel through a vacuum. Sound is made up of "waves," and there has to be something, air, water or what-have-you, for the sound waves to "wave" if the sound is going to travel. But what about light?

By the middle of the last century it had been pretty well accepted that light was a wave phenomena. But, if light was a wave, how could it travel through a vacuum, as it obviously did? What was it waving? Was space really empty? To answer that question, scientists reached back over two-thousand years for a concept which would allow light to "wave."

Aristotle, in about 350 B.C., postulated that the heavens were made up of a fifth element (the other four were earth, air, fire and water), and he named this element Aether. The revival of this element, now called ether, made things a lot simpler for the scientists, giving a medium for such diverse forces as magnetism, gravity and light to work in—and on.

The existence of ether also gave the basis for "proving" Newton's various laws of motion, which required a fixed point in space. Newton himself had theorized that the fabric of space, the ether, was motionless, and that everything else moved in relation to that motionless ether. This is the exact opposite of Einstein's later theories of relativity, which assume that no place is at rest, and that all motions are relative to another motion.

In 1887 Albert Michelson, an American theoretician, decided to try an experiment to prove the existence of ether. He believed that if the ether was motionless, and the earth was moving through it, then a beam of light directed along the path of earth's travel, and then reflected back to an observer, would travel a shorter distance than a beam of light sent at a right angle to earth's direction of travel and then reflected back. But first he needed a device to measure the difference with. That device was the interferometer, which has since proved to be one of the most invaluable of astronomical tools.

Right at the start of the Nineteenth Century Thomas Young discovered that light waves could, under certain circumstances, shine out of phase, with the peak of one wave arriving at the same time as the trough of another wave, producing a black band, called an interference band. In effect, two beams of light could be used to produce a band of non-light. Michelson reasoned that, if one beam of light travels a longer distance than another, both originating from the same source at the same time, one would arrive out of phase with the other, and an interference band would be formed.

Because of the refractive differences in the mirrors and the semimirror (see drawing), interference bands *were* formed. But, when Michelson, and his partner, Edward Morley, turned the disc holding the mirrors at right angles, which should have changed the interference bands was the earth's velocity with relation to the ether affected the speed of the light beam, there was no significant change. The Michelson-Morley experiment, which had been designed to prove the existence of the ether, instead proved that it did *not* exist, that the classical physics of Newton were nothing more than partial, and not always correct, explanations for *observed* phenomena, and opened the way for the development, thirty years later, of Einsteinian physics. And, finally, as a result of this experiment which failed, in 1907 Albert Michelson became the first American to win the Nobel Prize!

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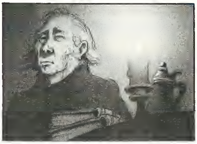

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VERTEX MAGAZINE, Volume 1, Number 4, October 1973 issue. Published bimonthly by Mankind Publishing Company. Business offices 8060 Melrose Avenue, Los Angeles, Calif. 90046.
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". . . (he) enters the foremost ranks of contemporary SF writers with this thoroughly anti-rational, anti-SF work."

Believe it or not, the above sentence is an actual quote from an actual review of what was presented as a science fiction novel. A review written by a science fiction fan and critic, not an "outsider." And, to me at least, that sentence tells a lot about just exactly what is wrong with ninety percent of the science fiction being published today.

To put it in its simplest terms, too much science fiction is nothing more than posturing by authors who have begun to take themselves much, much too seriously. Authors who have forgotten that they are writing to entertain an audience, rather than to impress a small, select clique of "professional" science fiction fans. It is only when trickiness with words, fancy twists of style, involved convolutions of character, become more important than the plot, the story itself, that such remarks as the above become possible. And, with the possibility of the above sort of *positive* review, the science fiction story goes out the window and the non-story, the pointless, plotless congregation of cleverly assembled words, becomes king.

Then, on the other hand, there is the work of writers such as Poul Anderson, Arthur C. Clarke, and, perhaps above them all, Robert Anson Heinlein. Unabashed and without shame, I, the editor of this magazine, blasé and worldly as editors are supposed to be, admit to a complete and terminal case of hero-worship where Mr. Heinlein is concerned. His latest book, *Time Enough For Love,* is reviewed on page 12—by another member of the Vertex staff, hopefully to allow a somewhat less biased opinion of Mr. Heinlein's work—and reading that book brought to mind a recent conversation I had with a member of science fiction's "new wave." I asked that person, who is excellent at writing those storiless stories, why he doesn't take notes from Heinlein's (or Clarke's or Anderson's or Harrison's or Dick's or Van Vogt's) style of writing, and add plot to his words. His answer was that the writing style of those above named authors "had been done" and was "old-fashioned." Well, maybe I'm old-fashioned, but I was raised to believe that writing had two aims: to please and entertain the reader, and to make money for the writer, with the former taking precedence (though only slightly) over the latter. Both personally and professionally, I hope that VERTEX, and science fiction in general, is able to find many more such old-fashioned writers as Robert Heinlein. They were writing good science fiction when the new-wave writers were using paper as something to chew on when their parents weren't looking, and they'll still be selling science fiction, and converting more new readers, when the last of the new wave is led gibbering away to the Great Speculative Writers Workshop and Screw Tightening Factory, there to spend their remaining days writing technically perfect nonsense to each other, stopping only to issue annual awards to their more discordant colleagues.

Donald J. Pfeil

Don Pfeil, Editor

NEWS & REVIEWS

News notes from the world of science and the arts—from space to the prehistoric past—From business contracts to book reviews—from ecology to spacecraft environmental systems.

HOME BREEDER REACTOR UNDER STUDY

WASHINGTON—A scientific meeting has been told that a potential new nonpolluting nuclear source of electricity—so small each household could be equipped with its own power plant—is undergoing testing at Rutgers University.

Research on the device was reported in a paper presented at a recent meeting of the American Physical Society by Yugoslav-born physicist Bogdan C. Maglich, a Rutgers professor.

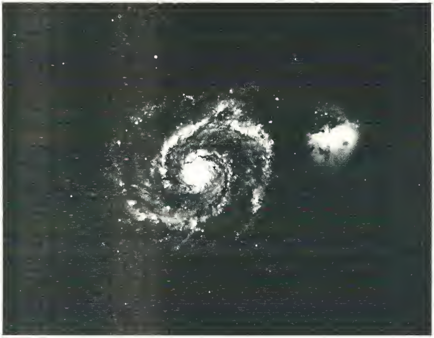
The device is called a migma cell after the Greek word migma, meaning mixture. Maglich said it is capable of breeding its own nuclear fuel and of generating electricity directly without steam, turbines or other intermediaries and thus without pollution.

The migma cell, Maglich said, involves the use of accelerated colliding beams of deuterons, the nuclei of heavy hydrogen.

The beam is injected in to a magnetic field designed so that it traces the figure 8 and thus "collides with itself" in an act of energy-releasing fusion, Maglich said.

He expressed confidence that through miniaturization a stack of 10 migma cells the size of a window air conditioner could provide enough electricity to power an average household. He said such generators could be mass produced.

Maglich and his associates at Rutgers have proposed a long-term research program to the Atomic Energy Commission which could lead to development of such a household-sized generator, he said.



GALACTIC CLUMPING POSTULATED

Matter in the universe is becoming more and more unevenly distributed as time passes, according to the theory of one leading U.S. astronomer, and is causing scientists to reconsider their previously held views about the origins and evolution of the universe.

The process, as described by Dr. Phillip Peebles of Princeton University to a meeting of the Astronomical Society of the Pacific on the USC campus, might be likened to the population shifts within the U.S. today.

More people are concentrating in the cities, and the cities are forming regional groups, or clusters. Something of the same sort appears to be happening throughout the universe, according to Peebles; matter is concentrating in the galaxies and the galaxies are increasingly clustering together.

Not Overnight Process

To be sure, the process is not an overnight one, but has been happening since the universe came into existence.

At issue what the early universe looked like. Was it a smooth and homogeneous blend of matter and radiation or was it a rough and irregular mixture?

"Some astronomers have thought the universe was chaotic at the start,"

turn to page 15

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IT WAS HERE, BUT IT ISN'T ANYMORE

A new comet has been added to the assortment of visitors that pass through the solar system.

But its discoverer, John P. Huchra, graduate student in astronomy at the California Institute of Technology in Pasadena, probably won't see his find on its next trip past the earth. It may not return for several thousand years.

Huchra's find follows by two months the discovery by Czech-born astronomer Lubos Kohoutek of another comet. That one is expected to become very bright as it approaches the sun next December.

Confirm Comet

Huchra discovered his comet on a photographic plate taken with the 48-inch Schmidt telescope on Palomar Mountain while he was searching for supernovae. His research is supported by the National Science Foundation.

Follow-up sightings with the 18-inch Schmidt telescope at Palomar confirmed its existence and now it has been officially announced to the astronomical world through the International Astronomical Union. Both telescopes belong to the Hale Observatories, operated by Caltech and the Carnegie Institution of Washington.

According to tradition, the comet will bear the name of its discover — and will be known as Comet Huchra.

Can't Be Seen

It is the first to be discovered by a Caltech graduate student since the 1950s. George O. Abell, now chairman of UCLA's astronomy department, discovered several previously undetected comets while he was participating as a Caltech graduate student in the Palomar Sky Survey — the first serious attempt to map the entire visible sky.

The new comet is about 150,000,000 miles from the earth, beyond the orbit of Mars, and can't be seen with the unaided eye. Its small tail is visible in photographs. Traveling at about three miles per second, it already is moving away from the earth.

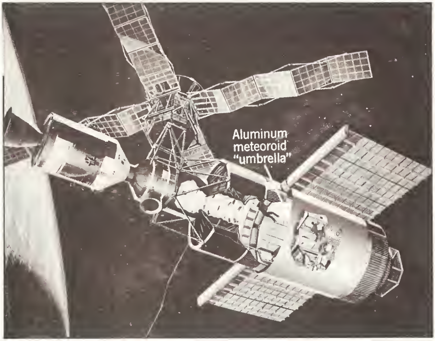
Additional sightings will be necessary to calculate its orbit with enough precision to say when it will be back. But the preliminary calculations suggest that it probably will be several hundred years — or perhaps even several thousand — before it returns.

Appears Near Sun

Comet Huchra joins a group of more than 600 comets that have been identified and named. Ninety-seven of these come within observing distance of the earth at least every 200 years. Some of the others won't be back for thousands of years.

Comets are made up of three parts — nucleus, generally believed to consist of a group of meteorite-like objects; a nebulous light called the coma, which surrounds the nucleus; and a tail, in the form of an elongated gas cloud, which appears as the comet nears the sun.

Most comets move in highly elongated, nearly parabolic orbits, and have paths that reach out of hundreds or even thousands of millions of miles from the sun.



SKYLAB INVESTIGATION BOARD

NASA Administrator James C. Fletcher recently announced the establishment of a Board to investigate the anomalies which occurred during the launch and initial Earth orbits of Skylab 1.

The Board will seek to determine the actual or probable causes of the anomalies which led to the loss of the micrometeoroid shield and the failure of the orbital workshop's solar power panels to deploy.

Bruce T. Lundin, Director of NASA's Lewis Research Center, Cleveland, has been designated Chairman of the Board, which will report to Dr. Fletcher and NASA Deputy Administrator, George M. Low. The other members of the Board will be designated in the near future.

Radioactive Waste Seeps From Storage Tank

An estimated 115,000 gallons of radioactive waste have seeped into the ground from a leaky storage tank but there is no danger to the public, the Atomic Energy Commission reported. The site is the Hanford Atomic Works, located 30 miles from Richland, Wash. Manager Thomas A. Nemzek said it would take 150 years for the radioactivity to decay. It was the largest of 16 such leaks since 1958, he said. The tank is one of 150. Once the leak was discovered, Nemzek said, the rest was pumped into an empty one. Corrosion was blamed for the leak.

U.N. JOINS ECOLOGY FIGHT

WASHINGTON — One year after its historic environment conference in Stockholm, the United Nations is quietly beginning to weave together a permanent organization through which the nations of the world can cooperate on environmental problems.

The stakes involve the fate of the world's oceans, forests, mountains and plains, its air and its energy.

But the fledging U.N. effort is all but unknown to the general public.

Two New Agencies

Moreover, environmental writers invited to a two-day briefing and conference on that effort had scarcely heard of two new agencies: MAB and UNEP.

UNEP, the United Nations Environmental Program, will bring into focus the environmental efforts of the U.N. Educational, Scientific and Cultural Organization, the most prominent of several agencies through which the United Nations has operated environmental programs for years.

MAB, the Council on Man and the Biosphere, is an outgrowth of a 1968 conference on the biosphere, the thin layer of earth, air and water that supports life on the planet. That conference was the United Nations' initial effort to focus its environmental efforts.

MAB collected 90 proposals for projects and boiled them down to 13 before the United Nations decided to plunge into environmental issues full force with last year's Stockholm conference.

Agency Set Up

That conference decided to set up the permanent UNEP agency, with conference organizer Maurice Strong, a Canadian, in charge.

MAB now will operate its specialized programs under the UNEP structure.

Under MAB's banner the United States has committed itself to cooperate on several international research projects.

And, although the contribution faces some difficulties in getting through Congress, the United States has pledged to UNEP $40 million of a $100 million U.N. environmental fund.

Noel Brown, Strong's UNEP deputy, said one of the first tasks facing its governing board is to see whether it can coordinate existing U.N. environmental programs.

15 Target Areas

The board has already selected 15 spheres of action.

The "action spheres" range from environmental pollution to economics and trade as they affect the environment.

The MAB program, which had a head start over UNEP, is farther along in its development.

Headquartered in Paris, it seeks to arrange international cooperative research to improve management of the environment and resources where man has created problems.

It was given four of the 13 research projects originally pinpointed with top-priority labels and has scheduled meetings of work groups on those four projects for this year and next.

A U.S. MAB participation committee told the briefing it has started doing its homework for those four meetings and is considering active participation in five other MAB projects.

SCOTT NAMED TO STANFORD STAFF

Montgomery Scott, an internationally known expert on dilithium crystal technology, has been appointed a professor in the Department of Aeronautics and Astronautics.

The appointment, which became effective April 1, was announced by Arthur E. Bryson, chairman of the department.

A native of Edinburgh, Scotland, Scott received his Ph.D. from Starfleet Academy in 1963. His doctoral dissertation on "The Purification of Dilithium Crystals by Negative Centrifugation" earned him a position as assistant engineering officer aboard the U.S.S. *Lexington* at the age of 24.

Dilithium crystals are essential to the conrolled fusion of matter and antimatter that powers warp engines of the type used aboard the *Lexington.*

In 1966 Scott became chief engineering officer of the starship *Enterprise*, where he supervised the operations of the engineering hull, including the two main warp engines. These engines, 504 feet long and 60 feet in diameter, were the largest of their kind ever built.

During his service aboard the *Enterprise* Scott received the Grankite Order of Tactic for his work in exploring strange new worlds and boldly going where no man had gone before.

When the *Enterprise* was retired in 1969, Scott turned to writing. He is the author of *Warp Engines in Theory and Practice,* a standard textbook, and numerous technical articles. His popular introduction to the subject, *Getting the Most Out of Your Warp Engine,* has been widely acclaimed.

At Stanford Scott will teach an advanced seminar on warp engine design. Warp engines have attracted attention as a pollution-free source of energy.

(Reprinted from the Stanford University Campus Report.)

THE MARGOLIS THEORY (?)

Aside from my experiments with steam made from milk of magnesia, my being elected Secretary/Treasurer of the L.A. Chapter of my suicide club, and my involvement with the Vietnamization of the Japanese Gardeners Association (all of which are beginning to take their toll on my strength), I had some time to further my investigation of a new concept of numbers. I'd like you, who are all the friends I have left now, to be the first to hear it.

The main axiom of the theory is that "The closer a number gets to positive or negative infinity, the denser it is and the farther it is (both in time and space) from the numbers around it."

This means that the number 10 is denser than the number 9, and closer to 9 than it is to 11. The reason for this is that there are more real rational and irrational numbers between 10 and 11 than between 10 and 9. As one example of this please look, for a moment, at the square numbers, 10% of the numbers from 1 to 100 are squares (1, 4, 9, 16 . . . 81, 100) whereas only 4% of the numbers of the second hundred, 101 to 200. You can see, each square in the second hundred if farther from the other squares than are those in the first hundred, and as there are less, each must do more of the work (in the second hundred, 2½ times the work of those in the first hundred).

What is true for any real number is true for all real numbers by definition, and what is shown for squares is true not only for cubes, quadrics, quintics, and so on, but also for prime numbers.

The fact that odd numbers and even numbers apparently keep the same proportions from one another is irrelevant in terms of their density or the spacing between them, and the mistake is simply solecistic (i.e., a mistake in grammer). The number "one," when representing a unit by itself, is quite different from the number "one," meaning the difference between two numbers in a series.

Einstein has shown, and it was later proved, that the faster an object goes, the denser it becomes, but it has not been shown *why* this happens. The answer is simply that the faster an object goes, the more dense the numbers are that it passes through. I'm not sure that mass is infinite at the speed of light (although for all practical purposes we can call it that), but it is not absolutely dense until it reaches the speed of infinity.

My patience is beginning to wear thin, but let me explain it one more way. The number of points on any line segment is infinite. There is only one infinity; there are not two infinities (positive and negative infinity occupy the same time-space and their difference is only one of art). Thus the number of points on a 1″ line segment are equal to the number of points on a 2″ line segment. If both lines are made up of the same number of points, why is one longer? It is because the longer one is made up of denser numbers (or points) and they are farther apart! (Points on a line correspond to real and rational numbers.)

It's true that "the power of the rational domain is everywhere dense," this was proven long ago, but only *two* dimensionally, not *three* dimensionally (or, looking at it another way, only three dimensionally, not four dimensionally).

This is still in rough form, but when I finish it I'll present it to the Acadamy of Higher Arithmetic in Leibnetz, Germany, this summer. I've already presented it to a group of small girls who come by on Wednesday afternoons to play doctor with me, and they thought it was swell.

Jack S Margolis

DEFINITIVE SPACE SHUTTLE CONTRACT

A definitive contract has been signed between NASA and the Space Division of Rockwell International Corporation, Downey, California, calling for the Space Shuttle system development.

Rockwell will be responsible for design, development and production of the orbiter vehicle and for the integration of all elements of the Space Shuttle system.

The contract has been awarded on a cost reimbursement basis plus fixed and award fees. It will be funded incrementally and the initial increment has an estimated cost including fees of $477,400,000. The contract supersedes the letter contract issued August 9, 1972.

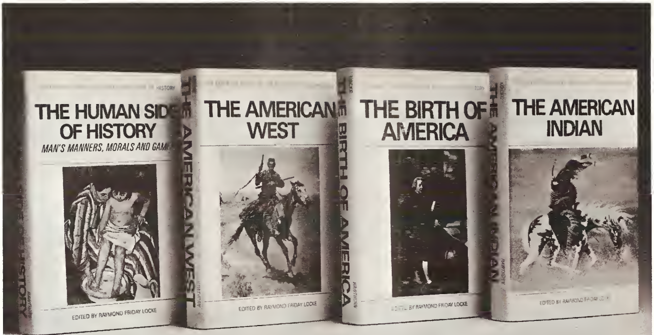
Apollo 16 and 17 Samples Exchanged With USSR

Rock and soil samples from the Descartes and Taurus-Littrow lunar landing sites were recently delivered to two representatives of the Academy of Sciences of the Soviet Union. The moon fragments were collected by U.S. astronauts during the Apollo 16 and 17 missions in 1972.

The handover of three grams from each mission was made by Dr. Paul Gast, Chief of Planetary and Earth Sciences Division of the Johnson Space Center. The samples were accepted by Vladimir Shcherbina and Lev Tarasov of the Academy of Sciences of the USSR Vernadsky Institute. Shcherbina and Tarasov delivered scientific papers at the recently completed Fourth Annual Lunar Science Conference at JSC.

JSC Lunar Sample Curator Dr. Michael Duke said that the samples presented to the Soviets represented the widest variety of soil and distinct rock types from Apollo 16 and 17.

The exchanges of samples from lunar landing missions is part of an agreement between the two countries for joint study of lunar material. The Soviets have also received samples from Apollo 11, 12, 14, and 15. The United States has received samples from the Soviet Union's unmanned Luna 16 and 20 spacecraft which brought back to earth samples of soil from the Moon's Sea of Fertility.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THE AMERICAN INDIAN

Edited by Raymond Friday Locke

Only within the last few years have white historians begun to look at the history of the American Indian objectively. This unique collection covers the highlights of Indian history primarily from the Indian point of view. Included are a history of the Pueblo Indians of New Mexico, the tragic story of the removal of the Cherokees from their ancient homeland, and the story of the man who almost organized the Indians into a unified fighting force. Among other selections in this rich collection are a study of American Indian humor and an essay on Red Power. Illustrated with fifty-four photographs, drawings, paintings, and maps.

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The West, that great, seemingly endless land of plains and mountains, of canyons and deserts, has always symbolized romance and adventure to Americans. It was peopled by some who were desperate and some who were heroic, all of whom seemed bigger than life. This collection of Western adventures includes articles on Jesse James and mountain man Jim Bridger, whose discovery of the Great Salt Lake was disbelieved by Easterners; profiles of Western artists Charles Russell and Frederic Remington; the tragic tale of the destruction of the buffalo; an account of the horrible massacre of Apache Indians at Camp Grant; and the stories of the Alamo and the American conquest of New Mexico. Illustrated with photographs, drawings, paintings, and maps.

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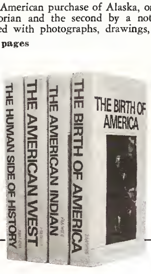

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vertex reviews:

TIME ENOUGH FOR LOVE

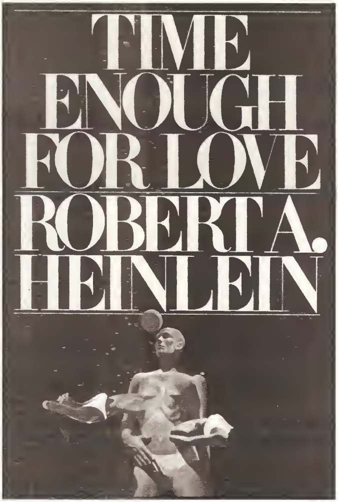
America's number one science fiction author sends forth a new bombshell of a novel, sure to entertain the faithful, sure to shock his critics and detractors.

review/**Richard Ashby**

What a wonderful book!

And, having said that, let's briefly examine some of its flaws. Methinks the master is making waves in science fiction's new-found sexual freedom. With the tragic passing of John W. Campbell a much more liberal attitude began to prevail in the field, even in *Analog* with the powerful novelette *The Gold At Starbow's End.* This is not to impugn the genius of Campbell, but he was . . . well, a bit crusty.

Although this book doesn't mark Heinlein's first incursion into an area previously the province of Traveller's Companion and Grove Press, et. al, it does signal the farest out he's reached. In the ebullient *Glory Road,* Hero had hankey-pankey only with the Princess. In *Stranger in a Strange Land,* Heinlein



explored the more piquant aspects of life in an odd commune. And in *I Will Fear No Evil* two different genders cohabit in one body. But in *The Lives of Lazarus Long* something rather outre takes place between son and mother. He has just about succeeded in inventing a new sin. I, for one, found it delightful . . . but will you? Different strokes for different folks.

The second flaw is a most minor one and it'll bother you only according to how much or how little you know about genetics. This reviewer knows next to nothing about it, so there were too many pages of keen sounding, but next to incomprehensible, ramblings on the subject. Unfortunately for me they are important to the book . . . not that it can't be enjoyed in technical ignorance. But it's like reading French bon mots and missing out on the delicacies of nuance in the original.

A real carper might bitch about the scrambled chronology of the book, but one soon learns respect for old Lazarus and takes his rememberings as he chooses to give them. After all, the man is 2,360 years old and entitled to ramble a bit.

I heard one reader exclaim his dislike for the two short intermissions. Nonsense. They contain pithy and delightful excerpts from his age-old journals. Such remarks as: *"A fake fortuneteller can be tolerated. But an authentic soothsayer should be shot on sight. Cassandra did not get half the kicking around she deserved."* And: *"A poet who reads his verse in public may have other nasty habits."* As well as: *"Sex should be friendly. Otherwise stick to mechanical toys; it's more sanitary."* They are such a pleasure that Ben Bova of *Analog* printed pages of them in lieu of a review. Besides, the book is structured as is a classical work of music with its Prelude, Variations on a Theme, Counterpoint, De Capo, and Codas.

From the jacket:

"It is a novel set in a time when not only the human population of the galaxy, but the very number of inhabited planets can be viewed only in approximations. It is the story—one must avoid the temptation to say life story, for that would be an overstatement—of the man who was born Woodrow Wilson Smith on the planet Earth in the year 1912 and is, as the novel opens, known as the Senior, the oldest man alive and to one degree or another the ancester of most, if not all, of the inhabitants of the planet he inhabits in the galactic year 2055, which in Earth terms would be 4272."

Well, yes.

But it is far more than that. It teaches you the heart-wrenching sorrow of having to part, after a normal lifetime, with someone you have loved . . . an ephemeral, who's span is only a pitifully short 50 or 70 years. It's the thundering thrill of the great Diasphora in a stolen starship, when the long-lived 100,000 are pulled from Earth to begin their dynasty.

It's World War One. It's object lessons on how to survive in the 1970s. It's love among the stars. It's belly laughs and history, past and future. It's the saga of a tired old man, and of the men we might become, given a chance and enough courage.

And *Time Enough For Love* is a glorious kick in the tail for the mewling incoherents who constitute the "New Wave" in science fiction, who take in each other's washing for their daily bread and award each other prizes, and who don't deserve to speak Robert Heinlein's name, much less be allowed to read anything as great as this book.

A pox on them.

Fortunately, this is a very long novel—605 pages. You should allow at least a weekend to it, for you'll want to savor entire chunks. Slowly.

It is rare good writing that can bring a tear to my eye. It did just that when Buck died.

Death. That's the enemy. And Robert Heinlein has killed it. ○

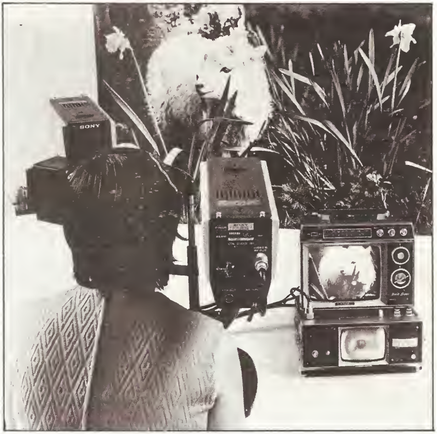
Eye View Monitor Measures Consumer Interest

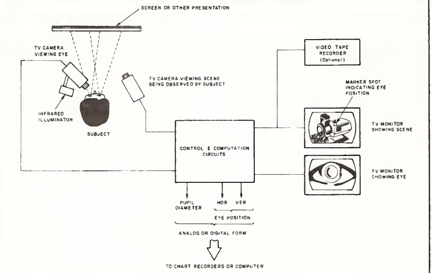
Whittaker Corporation's Space Sciences Division has announced development of a system for evluating human response to visual stimuli. By monitoring eye movements, the system can determine the most significant aspects of what a person sees from his own viewpoint. Also, by simultaneously measuring the subject's pupillary response (pupil dilation and contraction), it can provide valuable information about his reaction to what he sees.

Called the Eye View Monitor (EVM), the new system incorporates a television pupillometer, which has been used in behavioral research at a number of universities for over two years. The EVM is comprised of an infrared light source, two closed-circuit television cameras with monitors, a control console, and an optional videotape recorder.

One camera is trained on what the subject is looking at (artwork, photographs, etc.), while the other camera is focused on the subject's eye, which is illuminated by the infrared light source. The first monitor screen displays the scene viewed by the subject with a moving dot superimposed to indicate his point of gaze. Meanwhile, the second monitor screen shows the pupil of the subject's eye as it dilates and contracts. Digital and analog outputs corresponding to both eye movement and pupil response are provided for chart recording or computer input. In addition, video outputs can be recorded on the optional videotape unit.

Potential applications of the EVM system include personnel screening, drug effect research, work load study, determination of stress tolerance, and evaluation of teaching techniques. However, the most promising area appears to be consumer research. Using the EVM, marketers, advertisers, designers and stylists will be able to analyze consumer reaction and retention with an accuracy never before posible. The range of potential subject matter is extensive: consumer products and packaging, advertising graphics, new fashions, architectural renderings — anything that incorporates color and form to attract, impress and influence.

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Soviet Moon Rover Stops Roving

MOSCOW — The Soviet Union's Lunokhod 2, a robot moon buggy that has prowled about the Le Monnier Crater since January, has completed its mission, Tass said recently.

The announcement by the official news agency, with no previous indication that the robot's systems were wearing out, prompted speculation the craft had an accident.

The Lunokhod vehicle was designed to pick its way across the rugged lunar surface using television cameras as eyes.

Lunar Scientist Gast Dead

Dr. Paul W. Gast, one of the nation's leading experts in the field of lunar geochemistry, died recently in a Houston hospital. Gast was chief of the NASA Johnson Space Center Planetary and Earth Sciences Division.

JSC Director Dr. Christopher C. Kraft, Jr., said, "Paul Gast's contribution to the success of Apollo and the subsequent scientific investigations of Apollo science data were truly outstanding. We will sorely miss his wisdom and scientific direction of our programs in the future."

"I personally feel a great loss of a close friend and most trusted colleague," said Kraft.

Another of Gast's colleagues at JSC. Dr. David W. Strangway, chief of the Geophysics Branch, said, "Paul will be remembered first and foremost as an outstanding scientist whose interest in the Earth, meteorites and the Moon led to a distinguished career in science. He was well known in the field of mass spectrometry and rare earth analysis on terrestrial and extraterrestrial samples.

"His insight and intuition in the application of chemistry to the study of geology will stand for many years as a pioneering effort," Strangway said.

"In more recent years, he was one of the major leaders in the Apollo Program," said Strangway. "He was an important member of the early teams that planned the science for the Apollo lunar landings and he was deeply involved in the analysis of the first returned lunar samples."

"After serving on a variety of NASA committees and as a sample investigator," Strangway continued; "he joined NASA as chief of the Earth and Planetary Sciences Division." In this capacity he managed the scientific team that conducted the lunar program.

"Even with this enormous burden of responsibilities," said Strangway, "he was able to be a creative scientist and to publish many good papers about the Moon. There is no doubt that his aggressive and dynamic leadership played a major role in the scientific success of Apollo."

Strangway said, "Paul had known for the past two years that he had a terminal illness and it is an outstanding tribute to his strength and leadership that very few of those around him ever knew he was ill."

Prof. Gerald J. Wasserburg, speaking for a number of lunar scientists meeting at California Institute of Technology, said, "Paul W. Gast was a principal architect of the unique collaboration between NASA and the scientific community which brought about the remarkably successful scientific experiments represented by the Apollo explorations of the moon. His individual participation in analytical studies and his over-view of the researches from many disciplines permitted him to make first order contributions to our understanding of planetary evolution in our solar system," Wasserburg said.

"Gast is known for his model for the accretion of the moon and its subsequent history. He developed a theory of the origin of the earth and the moon based on understanding chemical variations in the abundances of potassium, rubidium, uranium, and the rare earth elements. He vigorously pursued his scientific interests and professional responsibilities until a few weeks before his death."

Gast joined JSC in January 1970, coming from Columbia University where he was professor of geology. Gast obtained his B.S. in chemistry at Wheaton College, Illinois, in 1952. He earned his master of arts and PhD degrees from Columbia. Prior to joining the Columbia faculty, Gast was for seven years professor of geology at the University of Minnesota.

Gast was responsible for supervising the analysis of lunar samples returned from the Moon in Apollo missions as well as taking part in planning lunar landing missions. He was author of numerous scientific articles in the field of geochemistry published in scientific journals around the world.

Gast was born September 11, 1930, in Chicago, Illinois. He leaves a widow, the former Joyce Rinehart of St. Louis, Mo., two sons, Mark 17, David 14, and a daughter, Judith 15. The Gast's live in Seabrook, Texas, near Houston and the Johnson Space Center.

GALACTIC, *from page 6*

Peebles said, "and the natural laws of physics would then explain what we see today. But I've always been suspicious of that."

Reflecting on Einstein's general theory of relativity. Peebles concluded that the universe started out as a smooth batter which — because of small gravitational irregularities — has grown increasingly lumpy with time. "It's chaos evolving out of order," he said.

Caltech astronomer Dr. James Gunn also spoke before the meeting, and his thoughts about the evolution of galaxy clusters complemented Peeble's theory.

Gunn speculated that galaxies may still be accreting, or putting together, the stuff of stars. He deduced this from the X rays which have been observed coming from the centers of many galaxies.

Although not the only posible explanation for this radiation, Gunn's theory is that the gas which is constantly being expelled from stars falls into the center of the galaxy. During the "infall," the gas emits X rays.

"If so," said Peebles, commenting on his colleague's work, "then the question arises: why is it in-falling? And perhaps the answer is, because of gravitational instabilities." ○

C AUSTIN·73

MAX

Will the man who comes after man continue to tolerate his ancestors, or will he merely use them for his own ends, in his own ways?

fiction/**E. Michael Blake**

artist / Alicia Austin

The government people want a super-child born, regardless of the consequences. They want an optimum upbringing, but they don't seem to care about the impact on you or your "mate."

Max came around slowly. He felt funny.

"Why him?"

Max didn't like feeling funny. He wasn't hurt—but he felt odd, as if there was an intangible stickiness sprayed over him. He never knew he could feel like that, and he didn't like his body doing strange new things to him.

"Why anyone?"

Blink, blurs. Blink, two. Blink, white.

"But *him.*"

A quick shake of the head riveted the scene into focus. Two lab-coated, bespectacled figures stood on the far side of the room, looking over a clipboard.

"He has nothing to do with it. He's just a vessel carrying half a potential."

Max took in their mild contempt. He tried out his voice. "Why *not* me?"

One coughed, covering his rudeness; the other just glared straight at Max, stoking up the annoyance in his look. They stood invincible amid lab equipment, control systems, readout consoles, and the other totems of their trade.

"You can go now."

In the lobby Brenda sat curled in a chair, near-foetal. She gnawed left fingernails, right hand fidgeting over her dull brass locket. Seeing Max emerge through a softly sliding door, she jerked up and bolted to his side.

He shrugged, half-smiled. "I'm okay."

Hunching against the odd surroundings, she let it go at that and followed him out.

They squinted at chrome glare in the parking lot. "Car's gonna be hot," Max mumbled. It was; they drove with the windows open, stalling the conversation. Nothing could pass between them but a wind-sliced "Whaa?"

Nursing cokes at a Burger King, Brenda finally assembled her nerve. "Are—they going to take you away?"

"Naw!" he laughed, shaking from his generous shoulders. "What gave you that idea?"

"Well," she gnawed her lower lip, tilted her head into one shoulder, juvenilely. "They're scientists. Doctors, and like that. Why do they wanna bother you so much?"

He shrugged at the tremor she had put in the word *scientists.* "They can't tell me where to go."

Worry whined from her plain, unlined face.

He jammed the straw around in crushed ice. "The whole thing is just this. You know how you pass things on to your kids? Looks, size, like that. That's called genetics. These guys say that my genes—the things that I'd pass on to my kids—would make my kid a superman, if I married one special woman."

She lowered her eyes. "What about us?"

His hands engulfed hers gently. "I don't care what the hell they want me to do. I'm marrying *you.*"

After teasing and funning around a few minutes, he got her smiling.

Max was all you could expect of a trailer camp upbringing in Flint, Michigan—and more. Twenty-five, big-boned, well-fleshed, sandy hair thinning congenially. A no-nonsense, meat-and-potatoes kind of guy. But, though he had readily accepted the tenets of lower-middle-classdom (he wasn't one of these ingrate kids who didn't give a damn how long and hard their parents had worked to give the kids a decent life), he wasn't a carbon-copy of his progenitors. He was *smart*—but he never made a big deal about it. He might have made it into U. of Michigan, but never tried. ("What's college supposed to do for me? I like plumbing.") Four years in the Navy had earned him some modest decorations for action in the South China Sea. Now, a few years on the job behind him, he was ready to get married.

They found something weird in his blood test.

Max found himself being steered into further tests by a narrow-tied HEW payroller who had bounced in from Washington immediately. The testing culminated in a counseling session with a psychologist.

"Well, Mr. Kalubas, you have quite a potential," Dr. Frayley said smilingly. Max tried to avoid thinking of Frayley as just another condescending, overeducated asshole looking down on a regular guy. It wasn't easy.

"So they keep telling me."

"But I think the people in charge have been handling it badly." Frayley lit a long cigar and drew on it, quivering the slight sag in his chin. "Genetics is still very much a hit-or-miss, uncertain field. Even if you are mated—excuse the expression—to the right woman, there's no guarantee you'll give issue to a super-child. But even if you do, you'll have problems."

"Like what?" Max asked, barely yawning.

Frayley cocked him an eyebrow, puffing luxuriously. "Mr. Kalubas—I'll call you Max, if you don't mind—Max, I don't think you're too honest with yourself. You act like you're nothing more nor less than a plumber, ignorant everywhere else. But I know you're smart. All the tests you took told us a lot about you, as well as your possible descendants. Looks to me like you're trying to cover yourself up in a sort of veneer of ignorance."

Max folded his arms. "What problems?"

Frayley paused, oozing smoke. "Well, your child could be so far advanced from you that your family life might be constant torment. The government people just want a super-child born, regardless of the consequences. They want an optimal upbringing, of course—but they don't seem to care about the impact on you, or your 'mate'. That's what I'm here for."

"If it's my kid, it'll do what it's told."

Again Frayley gave Max an analyzing glance. "Do you get along well with your own father?"

Max grunted disgust. "Yes, I get along well with my father. I love my father. Whaddya think I am, one of these Oedipus types?"

"How were you brought up?"

"Knowing he was boss. He didn't mess around—he believed in discipline, and so do I. And I thank him for making me what I am. Satisfied?"

"Certainly." Frayley twirled his cigar against an ashtray, flaking off ash with a slowness that grated on Max's patience. "But are you so sure you can do the same for your child—if he or she is so advanced as to be virtually a new species?"

Max folded his sinewy arms. The thought had occurred to him before. But reflexively he shunned, or ignored, the responsibility for his wonderings—pure non-pragmatic thinking had never had a high value for him. So he was not at all troubled when his eyebrows firmed themselves slightly and his voice produced, "a kid's a kid."

"I assure you, the government people won't agree," Frayley pressed, "they'll want an optimal environment, as I said, for the child. As such, you may not have much say in the matter. Either you'll have trouble accepting that, or trouble trying to cross the government. Trouble either way."

"Nothing I can't handle. I'm an adult, I'm not so helpless that I need someone to tell me what I'm thinking."

Frayley didn't balk at the sharpened hostility. He mouthed his cigar and looked thoughtfully at his patient. "Don't you?"

Flint was tense. The automotive Big Three were in financial trouble; thus Detroit was panicky. Panic in Detroit is reason enough for tension in Flint.

The city agencies had their hands full with the Arab, Pakistani and Hindu immigrants that were flooding in via the 1977 Shelter Act. Not only did these cultures rub against the established one—vandals constantly raided the construction site of Flint's first mosque—but they brought their own conflicts to the new locale. Hardly a week passed without a Hindu-Moslem flareup in Norfolk, Oklahoma City, Seattle, etc.

Despite this, the human experience continued. Environmental effects had started paying off in an ever-cleaner Lake Huron, while the Wankel engine reduced the daily abuse of the air (though causing some of the panic in Detroit). And whether jobs were plentiful or scarce, plumbers always had work to do.

Max was replacing some pipes in a kitchen sink when the housewife there started griping about abortion laws. It was here, Max decided later, that the thought was planted into his head—later to blossom into nightmare.

"Just ain't decent," she declared, leaning against the counter. Her faded flower-print apron covered a dim green blouse and tan slacks. Not far past thirty, her body still had some appeal—but stringy hair and an increasingly drawn face (brought on by two children, 10 and 12, about to explode into adolescent rebellion) made her look like someone about to get very old, very soon. She drank occasionally from a tumbler of orange juice which she kept poised near her lower lip. Max was a few feet away, on his back, unstressed by the routine chore.

"What isn't, ma'am?" Max always had time for courtesy, if needed.

"These girls going around however they please, bare-bosomed and all. Getting in trouble and then just finding a doctor to get 'em out. Abortions are so easy to get, morality just doesn't stand firm."

Max found himself neutral on the subject. He liked to have his fun—with Brenda, with others before her—but to him a woman was worthy of respect. With his emotions balanced, he came out indifferent.

"The Pope knows," his interlocutrix went on, "but nobody listens. A baby is a baby, born or unborn. Who can honestly say life starts at birth? It's at conception, when—uh, when it's conceived."

"Suppose so, ma'am."

He awoke fog-headed. He wasn't prone to dreams—remembering them, at least. But hypothetical events swirled in his mind—and sorted themselves out tentatively as he showered. It was technically a nightmare, because he didn't feel good about it. But the overall effect wasn't frightening or alarming—it fell somewhere between annoying and disquieting.

He stood in front of a statue. The Thinker. It regarded Max and said, "When is life?"

Max—a presence, a non-being, and identity which he embodied as himself to recall the dream—said, "I don't understand."

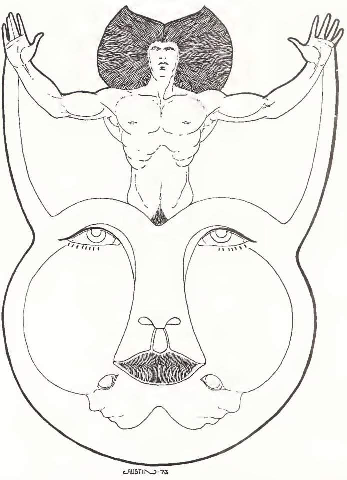
"You will have to," the Thinker replied, "you must understand and accept. You must be reachable."

"Reachable?"

"You must diminish the pragmatic. Begin to accept the fanciful. Banish your ignorance reflex."

That was it. Max couldn't piece the rest together too well, though he knew there was more to be pieced. The most bothersome part was *ignorance reflex*—something nagged at him, tried to convince him that those words were wrong.

But he wasn't one to waste time on dreams—or tarot cards and astrology,



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which Brenda tried to enter into their conversations now and then. When he got in the truck to go to work, the dream was gone from his thoughts.

Zuker was a hard-boiled egghead, the sort one would expect to be running a teacher's union. He chewed breadsticks noisily while the spaghetti was on the way. Max craned his neck to look at the time every 20 seconds or so.

"How d'ya know you won't like her?" Zuker pressed. He had his coat off, tie loosened, collar unbuttoned. He had none of the precise, courtly, condescending ways Max expected from bureaucrats, but he still wasn't likeable. Zuker was gung-ho for the project in his own way, and that was enough.

"You just don't get it, do you?" Max said, getting a little worked up. His hands rose over the table, itching to gesture emphasis. "I'm in love with another girl. I'm going to marry her. *She's* going to have my kids."

"Listen, I'm not saying anything about marriage," Zuker said generously, "just get this one broad knocked up. Is that so hard?"

Max frowned. "Since when does the government say it's okay to cheat on your wife?"

Zuker eyed the ceiling. "Kalubas, this ain't an election year. And I'm civil service. I don't have to con the hung-up hypocrites into voting me back into office. I'm running a project, and I'm after results. PR be hanged."

Silence began. Max, without a ready retort, exhaled.

Zuker got technical. "Artificial insemination with human sperm isn't sophisticated enough yet. We can't assume there'll be enough breakthroughs in enough time. Your 'mate' is 41. We can't pass up the possibility of a super-kid, so we have to make do with what's available. You gotta hump her."

Max shook his head. He was getting nowhere. "What if it's just an ordinary kid?"

"Then you keep trying. Every nine months, until she closes down."

"Until she what?"

"Goes into menopause. Can't have kids any more."

If the whole thing hadn't been so ridiculous, Max would have been outraged. But he had no intention of taking HEW's generous monthly dole to go through the whole thing—so it wasn't worth getting mad about.

—is that it? or is it that you aren't as against it as you—

Max started. An odd, vagrant thought. Suddenly he was aware of the forkful of steaming spaghetti in his mouth, fork tines hard against his tongue. He felt the varied textures of his clothing; his nose was drenched in aromas. He was possessed of a sudden alertness, observations forcing in at him. I'm eating with Zuker, even though I don't want anything to do with him or his project. Do I need a free lunch so bad?

The sensations vanished, leaving him disoriented. Mechanically he pulled the fork out of his mouth.

"Besides, the broad is nuts about the project," Zuker had gone on, "she's already ditched her husband. Got a divorce and gave him their three kids. She's changed her whole life, hearing about you. You wanna let her down?"

Max narrowed his eyes. He was back at the here-and-now, scowling at Zuker. "You feel for her so much? Why so considerate?"

Zuker shrugged, dispassionately abandoning a failed tactic. "She ain't so bad. Kept in shape nice—I've met her. Wouldn't mind having your genes right now."

"So you don't care?" Max pressed. (Why? You trying to talk him out of it? Just get up and leave.)

"We've got Frayley on the payroll to

turn to page 88

THE BIOGRAPHY OF A STAR

article/**Igor Bohassian**

To start with, let's get one central *fact* out of the way. Nobody *knows* just how a star is born, what stages of life it might go through, or how it will die. There are, of course, many theories, and even some evidence indicating one or the other of those theories is possibly correct. And there is the "common" theory which is most accepted (and which seems to change every couple of years). But nobody *knows!* Not even me. With that out of the way, let's take a look at the probable life cycle of a star. This is not exactly the way you will find it in many of today's astronomy books, by the way. Many parts of it are generally accepted, but the synthesis, the putting together of all these parts, the assumption that there is one "long" cycle rather than several different possible cycles, depending upon what kind of star is initially formed, is a new and still somewhat unaccepted idea. You have been warned.

The most common form of matter in space is not, as one might suppose, stars. You look at the night sky and see all those points of lights, but they only make up a small part of the totality of matter. Much more common are the immense clouds of gas and dust which make the term "empty space" virtually meaningless.

Every atom of matter has some amount, admittedly small, of gravitational attraction, and in the immensity of the cosmos it would not be unusual for two atoms, probably of hydrogen, to pass each other so close, and moving so slowly in relation to each other, that their gravitational attraction would hold them in close proximity. The increased attraction of two atoms might well make it possible for them to capture a third, then a fourth, and on and on. The more atoms captured, the stronger the gravitational attraction, and the more atoms captured. Soon those two atoms have grown into billions of atoms, gathering together in one spot, falling together and heating as they collide in their falls. Millions of years may pass before the heat grows to a self-sustaining point, but eventually this protostar will become hot enough in the center for hydrogen atoms to begin to fuse into helium, and a star is born.

As a general statement, the physics books say that four hydrogen atoms can fuse to form a helium atom. Actually, though, four hydrogen atoms are equal in mass to 1.0071 helium atoms, and something has to be done with that extra .0071 of a helium atom. What happens is that it is destroyed, and the destruction is that described in Einstein's famous formula, $E=MC^2$. That is, the amount of energy (E) released by the fusion equals the mass of the destroyed matter (m) multiplied by the square of the speed of light (c). In our sun, as an example, that .0071 amounts to some four and one half million tons of mass destroyed each second, and when that mass is multiplied by 90

The Dumbell Nebula is the remnant of an exploded star, and the expanding wave of gas will eventually, at least in part, become the stuff from which a new star will be formed.

million billion (c^2), you get a figure of some 380 million billion billion watts of energy being released each second.

But, let's get back to our collapsing cloud of hydrogen and dust. As the atoms fell towards a common core collisions began heating them, which eventually started the fusion reaction. At first there won't be too many atoms fusing, but as more and more atoms crush into the core, more and more fusions will take place, until eventually the explosion taking place in the core becomes strong enough to overcome the force of gravity pulling atoms into the core, and the new star stabilizes — at least for a while.

After a few hundred billion years a new problem begins to crop up in the interior of the star. All that helium that is being made as hydrogen atoms fuse has to go someplace, and, being heavier than hydrogen, the helium atoms, the "ash" of the fusion reaction, sink to the center of the star. As the ash piles up in the center of the star it squeezes out the fusing hydrogen, forming a "solid" ball of helium (actually still a gas, but relatively uncontaminated by hydrogen), which has no internal reaction going. Without an internal reaction to provide light and explosive energy to counteract the gravitational attraction of the sun, the helium is squeezed tighter and tighter, until the heat of that squeezing is enough to step up greatly the rate of hydrogen fusion going on in the outer layers.

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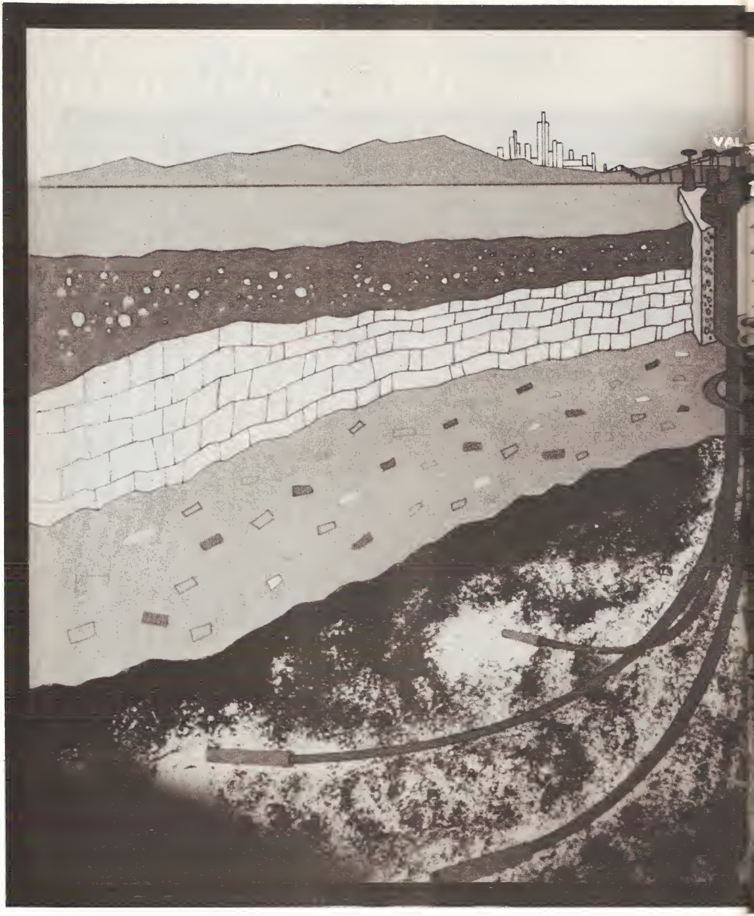
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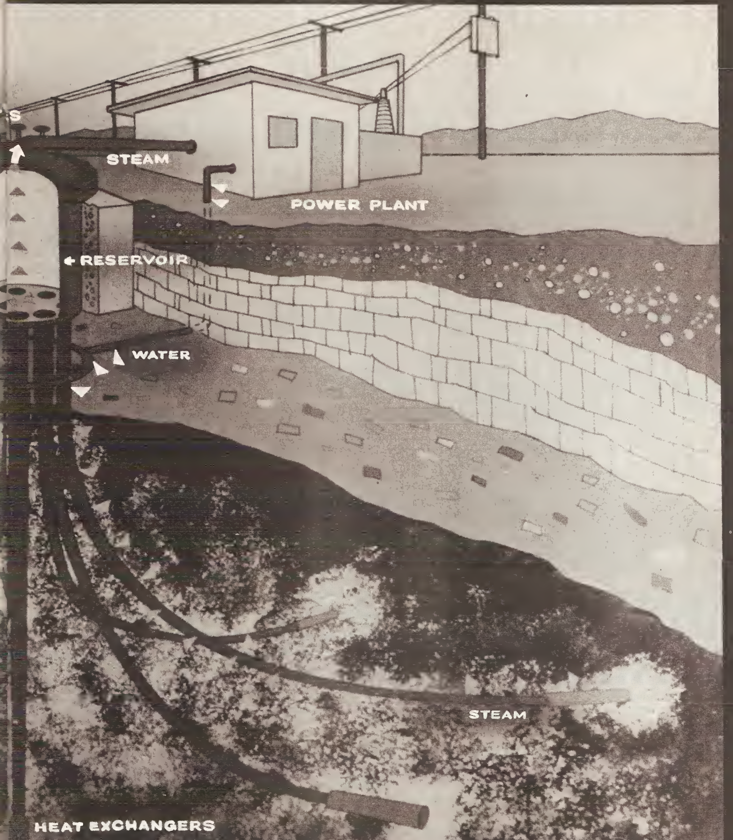

Mother Nature's Home Remedy

GEOTHERMAL POWER

article/**James Sutherland**

From Palm Springs south a hundred miles to the dusty Mexican border, California's central Imperial Valley is being systematically poked at, measured, drilled and blasted as the latest and strangest landrush in local history gets under way. Long-time Valley denizens who, in years past, successfully weathered previous swarms of farmers and tract-home developers admit they're perplexed. For the newcomers don't seem to care whether the rich topsoil of the Imperial can support bell peppers, beans, or prefab *ranchos.*

The strangers are sounding the Valley bedrock, searching avidly for something nobody up to a few years ago even suspected: steam.

Since 1970 half a dozen utility and oil companies, backed by an impressive array of California banks, have sent crews of geologists, seismologists, electrical engineers and ex-oil riggers into the Imperial to locate likely sites for future geothermal power plants. After three years of extensive probing and sinking of test wells, the hoped-for data is starting to come in, suggesting that the Valley contains quite literally the hottest piece of real estate in North America—possibly in the world.

A mile below the area around the Salton Sea the temperature of the underpinning rock is as high as 340 degrees Centigrade. Deep pools of briny water have been gathering there over the eons, warming past the boiling point, changing into high-pressure steam. When tapped, the power-generating potential of that steam, estimates the state's Geothermal Resources Board, ranges "up to 30,000 megawatts, approximately equal to the present total power generation capacity in California."

Several engineering breakthroughs and a couple billion dollars in development costs lie between that estimate and present-day reality, but few involved in the Imperial Valley project doubt its eventual realization. In most minds it is only a question of *how soon?*

Given the ravenous energy-consuming habits of the nation, it cannot be far away. Americans already use a full third of the world's energy resources, employing a quarter of that total to generate a staggering two billion kilowatts. Every two decades the consumption of electricity doubles, and the rate of increase itself is expanding as the spread of population continues virtually unabated. More people require more energy; by the end of this century the United States will be needing almost five billion kilowatts.

It is precisely this future that is impelling research and development of geothermal energy in this country, so much so that the United Nations estimates that in two years more electricity will be generated here by this means than by the rest of the world's geothermal plants in some thirty other nations. That, in itself, is hardly remarkable; what is difficult to grasp is the suddenness of the interest in geothermal energy. Only five years ago it was openly dismissed as "minor," or worse, some kind of hopeless technological boondoggle.

Exactly what occurred to trigger this change in attitude is hard to pinpoint. Certainly, the promise of geothermal energy has existed, in principle at least, for as long as people have been around. Krakatoa and Pompeii have provided vivid demonstrations of the unharnessed heat lying just beneath the surface of the Earth. Yet, for almost all of history, men have oddly neglected that immense potential in favor of that other accessible primal energy source—the sun.

The sun and its terrestrial by-products provided people with fuel even before they completely emerged from the caves. And, over the centuries, the use of wind and burning wood has given way steadily to coal and coke, then to oil, kerosene, gasoline and most recently, propane and natural gas. A survey of American energy usage in 1970, published in *Science* last year, showed that ninety-six per cent comes from these fossil fuels. Of the remainder, three percent was hydroelectric in origin, about one percent came from nuclear generating reactors and only a minute trickle from geothermal sources. For all intents and purposes, then, geothermal energy was forgotten. Or ignored.

This curious dichotomy is sunk deep into most cultures of the world today, and echoes of it turn up everywhere, even in mythology. Ancient religions regarded the gods of the sun as benign deities; Ra and Apollo were commonly believed to be kindly disposed toward men, bringing them the light every morning and chasing away the darkness and the gloom. In contrast, the geothermal spirits (if that's the right phrase) come off rather badly. Typical of them was the Hawaiian goddess Pele, a lovely but cranky misanthrope who dwelled in the active volcano Kilauea and had the dismaying habit of frying in lava those mortals unlucky enough to encounter her when she was feeling playful.

Old patterns of thought die hard, so it should be no wonder, then, that modern man has inherited a hearty predilection for the sun's energies, along with a distinctive mistrust of the power in the Earth. Solar energy, accumulated over vast stretches of time in the bodies of tiny animals and plants, is the driving thrust of civilization. Hydrocarbon fuels—gas, coal and oil—burned by countless machines, light and heat the cities, run the factories, even sent a few men to the Moon and back. It's been pleasant living.

But as any ecologist worth his diploma will add, it's also nearly been our undoing.

All that petroleum and coal, cheerfully blazing away for centuries, has released millions of tons of pollutants into the air. The smoky miasma that wafts over much of the countryside these days is the direct consequence of humanity's unfailing infatuation with old Sol. Ironically, in major cities half the time the sun can't be seen for the smog, anyway, leading more than a clutch of observers to conclude that humankind, *in toto,* is trapped in some planetary Black Gang.

Back in the infancy of steam navigation, the Black Gang was in charge of stoking the boilers with Pennsylvania bituminous and holding the line pressure to the engines steady. Since maritime safety laws were unknown then, the effect of their working conditions was terrifying: scalds and burns from coal-dust explosions were routine hazards, while the sulfurous dust made lung cancer as common as the grey pallor of a stoker's face. The fumes and heat dried up their eyes and mouths and pushed a good many firemen straight into madness.

And on any sultry, smoggy midsummer afternoon in a big city, the Black Gang and the pounding boilers don't seem so far removed.

This unsettling apprehension, coupled to the almost complete certainty that sun-derived hydrocarbon fuels will be long gone in seventy years, is sparking renewed interest in the possibilities of geothermal power to generate electricity. Along with the oil companies in the Imperial Valley, several colleges, including the University of California and the Massachusetts Institute of Technology, and various government departments have well-funded research projects investigating exactly how and why geothermal energy comes into existence. Already they are starting to piece together their data into a fascinating picture of the activity taking place only a mile or two under our feet.

Geothermal power originates in the constant natural radioactive decay in the Earth's mantle, the 2,200-mile thick solid wrapping around the molten planetary core. Extending to within ten or twenty miles of the surface, the mantle is studded with intensely hot regions capable of liquifying rock by raising its temperature many hundreds of degrees. The great pressure of the surrounding solid rock forces the magma, as the liquid rock is termed, up along cracks or faultlines through the lowest level of the Earth's crust.

If the magma can fully penetrate this layer of crystalline rock, it can come in contact with water seeping down from the ground above. The result, of course, is steam that sometimes can build to fantastic pressures: the most extreme example being the island of Krakatoa in the East Indies. There, porous rock admitted so much seawater into the so-called magma reservoir that the limestone lid could not hold, and Krakatoa exploded upward from its roots on August 26, 1893.

Such violence is unusual. More frequently the steam escapes gradually from the reservoirs and condenses into warm water on reaching the surface. Long before the Middle Ages these hot springs were well-known in Europe for their reputed therapeutic qualities. Indeed, they were a source of consternation to early Greek and Roman philosopher-scientists who, disdaining on-the-spot observations, had firmly announced that the Earth was a mixture of the two "elements," cold and dry. And that was that.

However, beyond the unknitting of some arthric muscles, the first practical use of geothermal power was accomplished by the Thirteenth century Icelandic scholar and rogue, Snorri Sturlason. Snorri is chiefly remembered as the author of the finest medieval history book, but he also led a wild life of larceny, brawling, wenching, hunting and sundry other outdoor sports. He was partial to hot baths and warm beds, definite luxuries in near-arctic Iceland. When one day he came across a furiously bubbling hot spring near his house, he soon rigged himself a series of channels and pipes to carry the water to his tub and through the walls and floors. It was the birth of central heating.

Although Snorri was assassinated by some of his criminal acquaintances, his ideas slowly caught on, and now over a thousand offices and homes are heated by hot-spring water in Reykjavik, while

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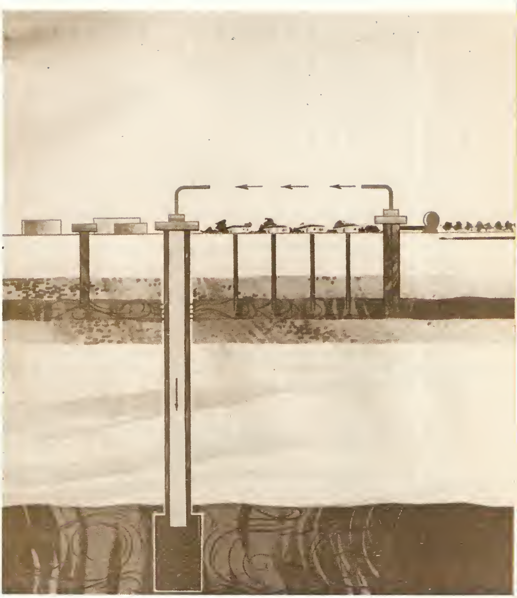
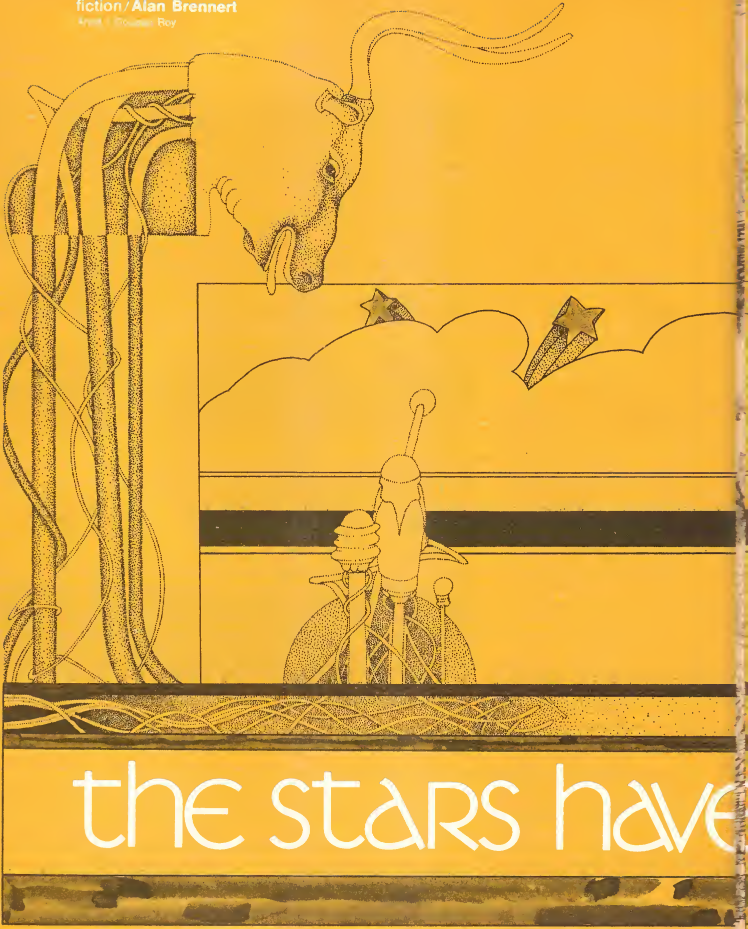


The geothermal heat energy displacement and recovery system envisages the transfering of heat energy from a deep geothermal stratum up and into a shallow porous stratum, to create shallow geothermal zones at desired locations.

fiction/**Alan Brennert**

Artist / Douglas Roy



the stars have

all gone out

Humphrey's due, the future he has worked so hard for, had finally come true for him, but by the gods of all stars, he could not share it with his wife, his star-matched mate, his Gloria.

Humphrey Delaney Parmenter, born a Taurus 6:48 P.M. EST 21 May 2025, consequently comfortable in an unvarying routine, finding security in security and absent happiness in work; waspish when forced to change his established manner of living, but yielding to the will of others for the sake of socio-economic relations. Sun in the Sixth House (the zone of health and work), as a result fastidious, exacting, conscious of health, hygiene, and the patterns in which he desired the world to move about him—smoothly, evenly, with a mobius-strip regularity that somehow never approached monotony. And as is common to all Taurans, due to reach his pinnacle of happiness and success in his middle years. Humphrey Parmenter at 43 years, five months, six days and an odd number of hours could have been said to be moderately successful and generally contented, but in no way in enjoyment of that promised peak of security. This worried him. At 43.416 years into his life, middle age if anything was, he felt it his due.

And there was certainly ample room for improvement in all of the many compartmented areas of Humphrey's life. Economically, his position at that time—junior file clerk for Sagittarius Section of StarComp, a government position thankfully secure and unshakable—netted him a tidy sum which could, nonetheless, have been appreciably tidier for his tastes. It provided Humphrey and his wife with a comfortable three-room semiluxury apartment on the twenty-eighth floor of a thousand-family housing complex in Flushing, New York, a roomy home blandly furnished and gratefully windowless; while those tenants living on the rim of the wheel-like floors of the building looked upon their windows as some arcane kind of status symbol; Humphrey saw little advantage in being assaulted daily by the grey wind that blew in from Jersey. But such little luxuries were just that, small and trifling, and Humphrey longed for release from this tiny cubbyhole of obscurity into a larger, more expensive cubbyhole of ostentation.

Domestically, too, Humphrey's position was none too good. His wife, Gloria, was a quietly efficient Tauran housewife, prim and neat but curiously mercuric in temperament, owing perhaps to having been born on a cusp, 20 April 2029. He loved her, of course, and had little doubt that she loved him, but home life could be disturbingly erratic at times.

"I don't see how you can live with it," she would pout, attempting to make certain that he could not. "It's embarrassing, degrading. We're both Taurans, both alike, your Sun is in the Sixth house, mine's in the First. That's supposed to be something special, isn't it? First and Sixth, something more than love, a rapport, an empathy, almost telepathic. We don't have anything like that, Humphrey, nothing at all. Oh damn, and I picked so carefully, too."

And Humphrey, at a loss to explain his deficiency in this area, could only fall back on that which he had been taught since childhood, that promised joy that had once seemed so desperately far away and was now in terrifyingly-near danger of being lost. "It'll come, Gloria," he would say, each repetition causing the words to fade just a little more. "It's our due. The stars look after their own."

But Gloria, aware that that promised zenith in both their futures might be anything under the stars, and not necessarily her hoped-for rapport, would turn away, quickly, coldly, petulantly. Which was totally Taurean.

And Humphrey would be alone once more, waiting. Always waiting.

25 Oct 2068: Parmenter Humphrey D: A certain amount of ambition is best displayed today lest others judge you apa-

thetic and unaspiring. Aim not for the top of the ladder, but the next rung.

StarComp, fifty stories of air-pocketed plastic freckled by humanity, laced with the muted crackle of the machines whose paper fingers touched the lives of all the pieces of sentient flesh within, and more. At night the building was a spectacular sight, the smooth dome that crowned it peeled open and turning, the great glass eye of the telescope piercing the darkness, searching the stars. In the daytime it was similarly impressive, towering above its stunted neighbors but never dwarfed by the freakishly tall Trade Center, or the grey and dying husk of the Empire State. Size had become a poor determinant of authority.

His daily forecast tucked neatly into a hip pocket, Humphrey allowed the massive exoskeleton of the StarComp Building to swallow him whole, glass doors swinging wide into a lobby of Jonihesque proportions. Determinedly, for such was his advice, he made for the banks of elevators stabbing upward into the superstructure. The lift carried him swiftly past half the Zodiac in its maddened flight to Sagittarius Section on the thirteenth floor. (The presence of such an unluckily-numbered floor alarmed no one in particular, since few people believed in such superstitious rot these days.) Humphrey felt taken up in its speed, in the pace at which he found his morning moving; sometimes, he reflected, routine had to be sacrificed for advancement, for happiness, for a greater security and a greater routine. Sometimes a man had to take the initiative—when the stars gave him that opportunity.

The doors of the lift hissed open, disgorging a suddenly-acquiescent Humphrey Parmenter into the clattering, imposing harmony of StarComp Sagittarius.

Greeting him came the purposeful chatter of typers, a good two and a half dozen of them working four times as quickly as the most feverishly efficient of human typists. The typers' operators, robotically competent and coldly computerized, were entombed far beneath the typers themselves, far below even the concrete floor of the city. The computers that were the actual interpreters of the stars, computers so adroit that they were able to program thirteen million individual and distinctive forecasts each day, were speaking in hushed tones of PL/1 to these typers, telling them to record each bit of Sagittarian forecast for that day and that city on never-ending sheets of crisp white paper. From there it was the job of token humans to file them, to miniaturize each line and each word of sage advice, to place each microdot of information on a strip of paper particularly its own and file it away until the next day and again and again and again.

A man's entire life might be no more than a six-inch strip of paper spangled with twenty-five thousand points of reference. Humphrey considered it an infinitely practical arrangement.

His determination restored by this display of smooth organization, Humphrey marched off to his own desk and the local feed-file terminal that handled the fortunes of those New Yorkers born on November 29th. That was a good million or so, but it would take Humphrey but a few hours to feed the ink-lined ribbons flowing from the #8 typer into the digestive system of the feeder, a compact little microphotocopier that hummed contentedly as it assimilated each piece of information. Once this end of the operation was set up, Humphrey was able to concentrate on the outcoming microdots and put each in its proper file. It was simple work, but not as satisfying to Humphrey as it had once been; he was inordinately efficient at his job, and was well aware that he was capable of handling far more. He could easily have handled an additional day's 'casts, but a two-day workload would elevate him from junior to senior file clerk, a semi-executive position with an accompanying jack in salary of almost one hundred dollars. Both the money and the status figured prominently in Humphrey's released ambition; *Senior File Clerk, Sagittarius Section, StarComp Manhattan* had a certain ring to it.

Precisely at 9:01 he settled down to work, sorting and filing and cross-referencing and every ten minutes or so stealing a quick glance at his partially-exposed forecast card, building his confidence by geometric progression: I can handle more/I can handle *more*/I *can* handle more!

The morning fled by, routine tinged with quiet determination.

When noon finally edged into his awareness, it came softly, and cut like a razor. Lunch break; the typers ceased their demented chattering, the workers left as if part of some group consciousness, but in actuality merely obeying a basic precept of industry left over from the twentieth century: When you can rip off with an employer's time, *go.* Humphrey lagged behind, moist fingers clutching his forecast. This was the moment.

Hesitantly he approached the office of Sagittarius Supervisor Bertram Winslow. He had not been in Winslow's office since his first interview for this job, more than fifteen years ago; with more than a little trepidation he tapped on the half-opened door. It swung open unexpectedly from the meek tap, revealing Humphrey to the man within . . . a dark, swarthy man of about fifty-five, deep brooding eyes, thick, heavy features. An indisputable Scorpio, impatient and authoritarian. He was, in fact, a perfect bastard when he was so inclined to be, although his astral profile didn't put it quite that way.

He looked up at the motion of his door. For a moment he strained to identify Humphrey, then nodded sharply in recognition. "Parmenter, yes. Wasn't that noon break I just heard? Something I can do for you?"

Humphrey stood suspended in the doorframe. He cleared his throat; his voice still emerged somewhat raspy. "Yes, there is, sir," he said, quietly at first but gaining volume as memory of the forecast rang in his head. "As you know, Mr. Winslow, I've been working a one-day load out there—I'm a junior clerk now—and, well, it just seems that at the end of the day there's just so much *more* I *could* have done. One dayload isn't really very much, you know, and I can get through it all in five or six hours and—"

"Have you?" Winslow said cagily.

Humphrey blinked. "Have I what, sir?"

"Have you been getting through your work in five or six hours?"

Humphrey said sheepishly, "Well, as a matter of fact, I have, but—"

"In other words," Winslow said, casting him a glance which might have turned lesser men to stone, plastic, or the synthetic of their choice, "you've been padding your work schedule, is that it?"

Humphrey felt a wave of panic sweep over him, a million voices screaming *Now you've done it, now!*, but then the recollection of the forecast came back to him and he trudged ahead. "Well, yessir, I have, and I think it's a terrible waste of the government's time, especially when I could be using that extra time for something else, like another day's load," and then it was out, all of it, and no reversing it no stopping it, *done.*

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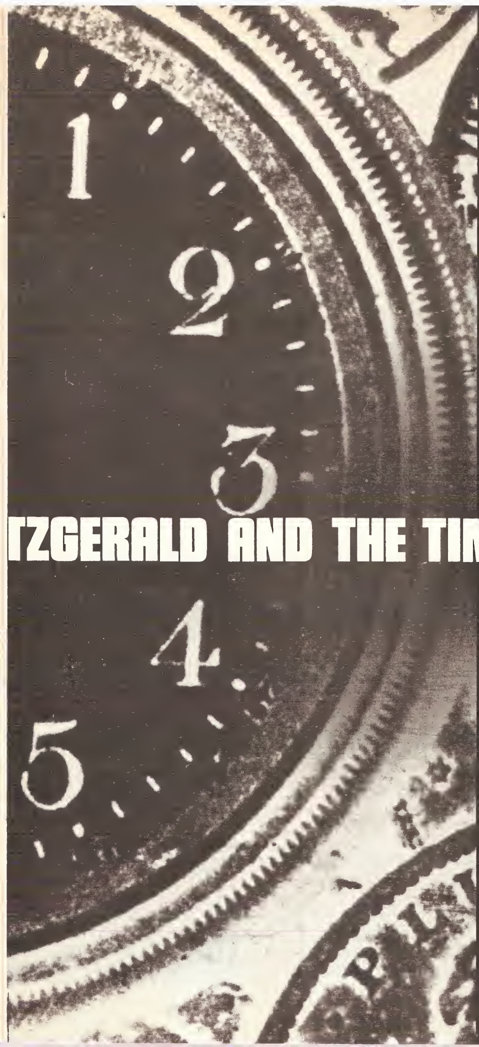
GERALD FI



TZGERALD AND THE TIME MACHINE

What's all this about you having a time machine?" I asked Gerald Fitzgerald.

"Never mind, I got one, I got one."

"Why haven't you told me before? You know how hot I am on science-fiction and stuff like that," I said.

"Just so," he said. "I knew that sooner or later you'd come over here wanting to use it to go into the future or back to prehistoric times or something silly like that."

"Look, lad," I said. "Why don't we get together and *do* something with it? It's big enough for two, isn't it?"

"It's mine," he said.

"Of course it is," I said quickly. "But think of the possibilities! We could go back in time to Atlantis and Mu and Rome! We could watch the Goths invade! The Rape of the Sabine Women! Cleopatra!" I was waving my arms a little. "We could take a peek at Helen of Troy and the Vestal Virgins and all those swell orgies. We could make sure about the Trojan Horse and even check up on the ancient Grecian gods. I've got a theory about that lightning bolt Zeus had being a raygun."

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The future may well hold events which no man can see and remain sane—assuming he was sane to start with.

fiction/**William Rotsler and Charles E. Burbee**

VERTEX INTERVIEWS FRANK HERBERT

interviewer/ ***Paul Turner***

"A writer needs time, uninterrupted time, with the tools of his trade. I think you get a kinesthetic link right through the body. The thought comes into your head and goes right through your hands onto the paper."

VERTEX: What got you started in science fiction?

HERBERT: Well, you can't pin a thing like that down firmly and get all the parameters of it, but I would say it was the fact I have a wild imagination and I really saw, back in the early fifties, that science fiction, very likely, is *the* mainstream. That everything else is kind of an attendant time-bound piece of science fiction. What I am saying is that science fiction has much more elbow room than other kinds of fiction. You can do much more interesting things, more widely divergent things, in science fiction than you can in mainstream fiction. This is not to put down mainstream fiction in any way. Each has its own function in our society and always will, I hope. You choose what you want to use for a particular kind of story, and in the early fifties I felt like writing science fiction. That's how I got started in it.

VERTEX: Had you been reading science fiction before that?

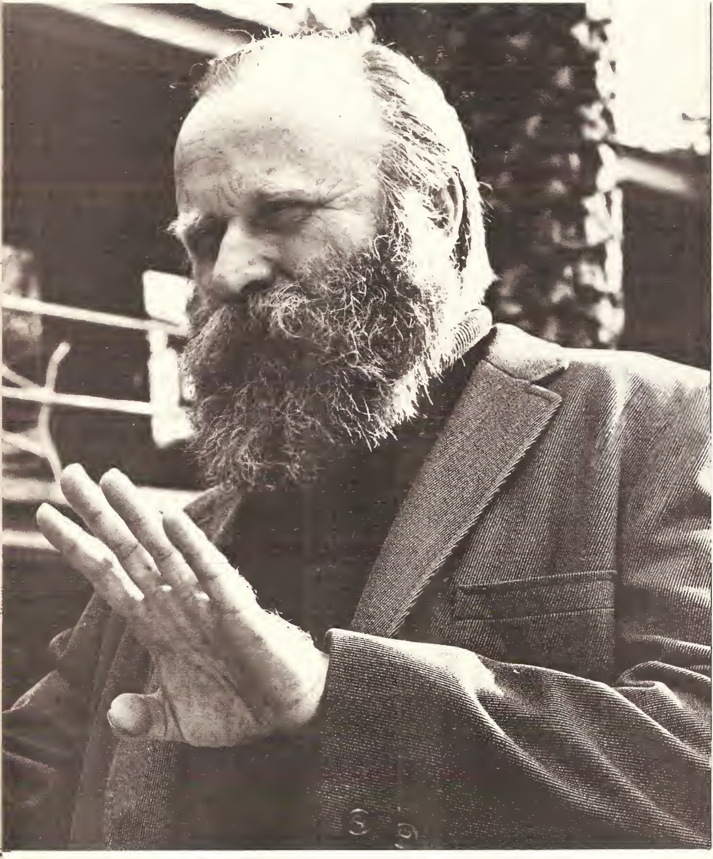
HERBERT: Well, I didn't cut my teeth on science fiction. I began reading science fiction, I would guess, in the forties, the early forties. I'd been reading science fiction about ten years before I decided to write it.

VERTEX: Who were your favorite authors?

HERBERT: Well, I did read some Heinlein. I shouldn't really tie it down to ten years because I had read H. G. Wells. I'd read Vance, Jack Vance, and I became acquainted with Jack Vance about that time. Jack came along about six months or so after I'd decided to write science fiction. I heard he was in the area where I was living, and just walked in on him one day. We wound up, about six months later, our two families, going to Mexico. We lived in Mexico for a while and plotted several stories together. We're still very close friends. I read Poul Anderson. You know, we could list names here for a long while. I read the field when I started writing it. I wanted to see what was being done.

VERTEX: What were you doing at the time you started writing science fiction?

HERBERT: I was a newspaper editor, but I was also writing fiction. I was writing short stories. I decided very early I was going to write fiction. I came down to my birthday breakfast on my eighth birthday and announced, formally and portentously,



"Science fiction, very likely, is the mainstream. Everything else is kind of an attendant time-bound piece of science fiction."

to my family that I was going to be an author. My mother still treasures several hand-scribbled, badly misspelled, early eight-year-old attempts at fiction. One of them doesn't have a bad lead on it. Even now I can appreciate that I had the sense to put a narrative hook on the beginning of a story, even at age eight.

VERTEX: *Dune* is probably your most well-known science fiction novel.

HERBERT: Yes.

VERTEX: What caused you to write *Dune?*

HERBERT: Well, I had been nurturing the idea to write a treatment of the messianic impulse in human society for a long while, and my technique is to collect material. I collect file folders of material. A character idea interests me, and I put that in a folder appropriately labeled. Along the way I went to Florence, Oregon, to do an article about the U. S. Department of Agriculture's test station there, on the control of sand dunes. The U. S. pioneered in the control of sand dunes by planting specially developed grasses and other plants to hold a dune in the wind. You see, a sand dune is just a kind of fluid, only it takes longer for it to move. It creates waves that, when you see them from the air, are analogous to waves in a sea.

VERTEX: A slow-motion sea.

HERBERT: Yes, that's right. So, I did this magazine article and I started collecting material on the control of sand dunes. That lead me into ecological matters—what we were doing to the planet. One day I woke up to the fact that I had a filing drawer full and that I just couldn't do anything else but write that book. So I sat down and I plotted a much longer work than *Dune.*

VERTEX: *Dune* is a pretty long work to begin with.

HERBERT: I know! It *was* much longer. I cut it up into three parts, and held out more than a third of it for the first book.

I sat down and took about a year and a half putting it together, writing it. My reports from the New York market were very poor and my treatment by some of the publishers back there was just outrageous.

Then I went back, even before I knew that *Dune* was being so successful, and wrote *Dune Messiah,* which was planned as a pivotal book, pointing both backward and forward, because I had a long range concept of the treatment of this messianic impulse in human society. I'm at work on the third and last one, which will probably turn out to be as long as *Dune.* How soon I can finish it, I don't know, because life and other immediate and urgent jobs keep intruding. But I'll get to it and I'll get it out, probably this year.

VERTEX: Do you have a title for it?

HERBERT: No. I have a working title, but I try not to talk about work in progress. My advice to any writer is not to use the energies of creation in talking about what he's working on; put it into the typewriter. You use the same energies to talk about your work that you use to write it. So I'm very cagey on these things, very secretive, and I hold all this back and then when I sit down at the typewriter it sort of pours out.

VERTEX: Talking about your technique, are there any special requirements that you use to write? For instance, do you need special environments?

HERBERT: Oh, I think we all need special environments for various things we do. A writer needs time, uninterrupted time, with the tools of his trade: paper and a writing instrument of some kind. Jack Vance uses pencil or pen. I think he has a rather interesting technique. He uses various colored pens; he has a dish of them beside him. When he gets tired of blue he writes with green, or red, or orange, or black. I use a typewriter. I think that's the newspaper training. I learned to type at about age fourteen and I touch-type. You train the thoughts to come out of the ends of your fingers in this particular mechanical way. I think you get a kinesthetic link right through the body. The thought comes into your head and goes right through your hands onto the paper, you see. So I need a place where I can sit down and not be interrupted for at least four hours a day, or six, and often much more.

VERTEX: Do you write long hours when you get inspired?

HERBERT: Oh, I don't wait for inspiration. I just sit down and work at creating the thing that has interested me from the start. The three books of the Dune series still interest me very much because of the way these impulses form in the organism we call human society.

VERTEX: There've been a lot of

changes in our human society, our human culture, since you first wrote *Dune.* Are you incorporating these changes?

HERBERT: Oh, yes. The book is being changed by experience. A man is a fool not to put everything he has, at any given moment, into what he is creating. You're there *now,* doing the thing on paper. You're not killing the goose, you're just producing an egg. So I don't worry about inspiration, or anything like that. It's a matter of just sitting down and working. I have never had the problem of a writing block. I've heard about it. I've felt reluctant to write on some days, for whole weeks, or sometimes even longer. I'd much rather go fishing, for example, or go sharpen pencils, or go swimming, or what not. But, later, coming back and reading what I have produced, I am unable to detect the difference between what came easily and when I had to sit down and say, "Well, now it's writing time and now I'll write." There's no difference on paper between the two.

VERTEX: That sounds like it might stem from your early newspaper experience, where you had to write regardless of the conditions or how you felt.

HERBERT: Yeah, you sit down and you just have conditioned yourself to: now it's writing time and you have a deadline sitting out there somewhere and you're going to do the very best you can right here at this moment; and so you do it.

VERTEX: What other things are you writing now, besides the last of the Dune novels?

HERBERT: Well, I've been doing the narrative script for a documentary about the navy demonstration flight team, the Blue Angels. It attracted me because it wasn't a conventional documentary; it wasn't just "here we're going to do some groovy things flying." I am a pilot, so I was interested from the flying point of view, but I was also interested because here were these fellows flying very hot aircraft and doing extraordinary things with them, and it struck me that they didn't really know what they were doing. They knew flying; they knew they were doing a great thing and they were getting all this elation out of it, but they didn't understand their relationship to themselves and the airplane and the rest of the world. What they were demonstrating to people was that a human being *could* actually do these really extraordinary things: flying two aircraft towards each other, for example, at a closing speed of eighteen hundred feet a second. You think about that—eighteen hundred feet a *second. And* pass within three feet of each other. They train themselves so that the aircraft flies them as much as they are flying it, only we had to tell them that they were doing this. They thought they were controlling the aircraft, you see. The idea of absolute control is a hang up of Western culture. It is built into our language; it's part of the verb *to be:* "Well, you either do it or you don't!" It's the old Cartesian dichotomy—the separation between body and mind. Well, there *is no* separation between body and mind.

VERTEX: You talked earlier about the world culture, a composite of all the cultures on the Earth. Apparently you've thought about this at some length. Do you see lines, trends, things that are common to all cultures, a trend that this culture is following now?

HERBERT: Well, I don't see trends if you're thinking of "where are we going," but I see many, many influences which are going to be mutually interactive, creating something new. Of course, you can talk then about certain things that are going to happen. I think that, barring a tremendous breakthrough in energy sources, which is always a possibility (it's our hope, our belief in miracles, you see), we are going to see animal dieback in human populations in some areas of the world. Specifically, in at least one area, I have other areas in mind, but the island of Java, which I visited last summer, now has a population of more than 80 million effectively living on land which is about the size of one-third of the state of Washington . . . 80 million people. They have urban density in the countryside. Now, they do not occupy all of the available land on Java, all of the available surface, but some of it is non-usable for human purposes under present circumstances. So, again barring some tremendous breakthrough in energy and food sources, an animal dieback will happen there because they are doing nothing about their growing population. They still have one of the largest population growth rates in the world. Now, and let's be conservative about it, if they double their population before the year 2000 that land will not be able to support them with present energy sources. It is barely able to support them now. So they are very close to a crash, to a population crash. Now, I think that the rest of the world will effectively be helpless in the face of it. You could not get enough food there and if you did you would only exacerbate the problem if you *just* gave food.

VERTEX: Why is that?

HERBERT: Because the pressures on a society, the pressures of danger, including the pressures of starvation, tend to increase the population. There is a thrust of procreation.

VERTEX: That's what happens during war times.

HERBERT: Yes, we come out of a war with more population than when we go into it, despite the losses in the war. So I am predicting that Java is going to experience a population dieback, a population crash, within at most fifteen years. That's going to have one hell of an effect on the rest of the planet. Not just the inability to cope with it in conventional terms; that is, produce food and give it to them, or whatever. But people are then going to look inward, at their own populations. Whole societies are going to look inward at their own efforts. I really believe that what we popularly call 'the change in morality,' that is, sex as recreation rather than procreation, is a social effort to cope with the necessity to limit the population and still deal with sexual drives.

VERTEX: So it's a high speed evolution.

HERBERT: Yes, I see it that way. Japan has been able to deal with its rate of growth rather dramatically. I see the same sort of thing happening in the United States. I do not see the same sort of thing happening in Muslim countries or in Latin America. Latin America is another area we want to look at in this respect, where the potential of population crashes exists because they are failing to deal with the problems in the face of the necessity to do so. If they do not limit population they must find other ways to deal with the increase, you see.

VERTEX: To get back to science fiction, what do you feel is the role of science fiction? Do you feel that science fiction can help, or is helping to solve some of these problems?

HERBERT: I think science fiction

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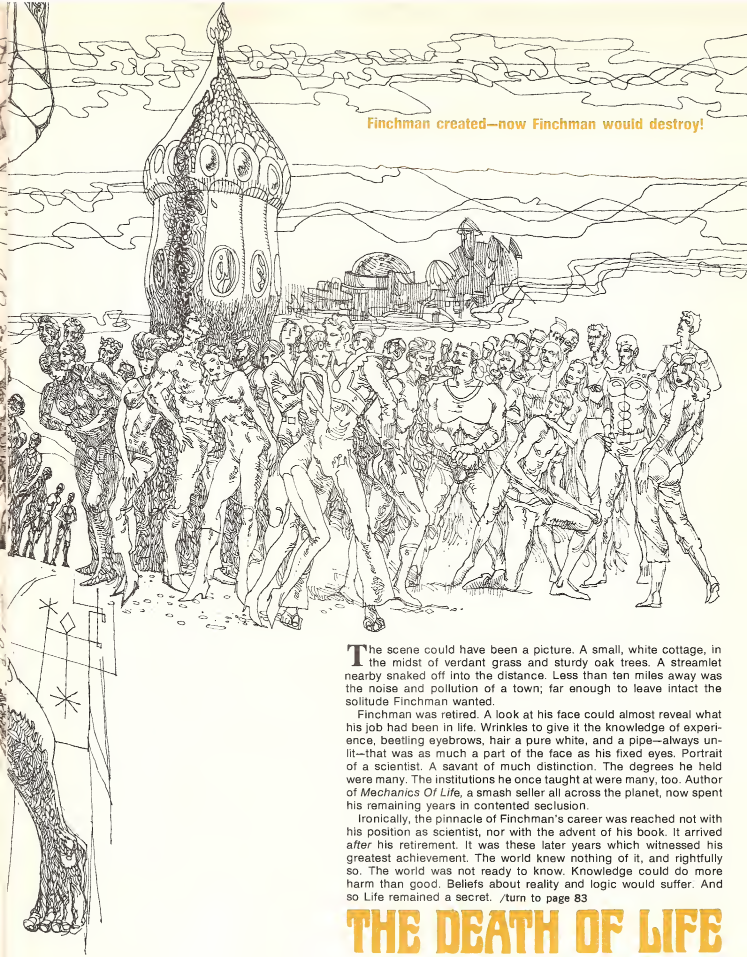

Finchman created—now Finchman would destroy!

THE DEATH OF LIFE

fiction/**Anthony Lorenti**

artist / Monte Rogers

The scene could have been a picture. A small, white cottage, in the midst of verdant grass and sturdy oak trees. A streamlet nearby snaked off into the distance. Less than ten miles away was the noise and pollution of a town; far enough to leave intact the solitude Finchman wanted.

Finchman was retired. A look at his face could almost reveal what his job had been in life. Wrinkles to give it the knowledge of experience, beetling eyebrows, hair a pure white, and a pipe—always unlit—that was as much a part of the face as his fixed eyes. Portrait of a scientist. A savant of much distinction. The degrees he held were many. The institutions he once taught at were many, too. Author of *Mechanics Of Life,* a smash seller all across the planet, now spent his remaining years in contented seclusion.

Ironically, the pinnacle of Finchman's career was reached not with his position as scientist, nor with the advent of his book. It arrived *after* his retirement. It was these later years which witnessed his greatest achievement. The world knew nothing of it, and rightfully so. The world was not ready to know. Knowledge could do more harm than good. Beliefs about reality and logic would suffer. And so Life remained a secret.

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KIRK

CYNTHIA

A will to survive and a desire to return home can drive a man to strange, and sometimes irrational, deeds.

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fiction/**Tak Hallus** artist / Tim Kirk

—*First trip to Earth?*

Startled by the interruption, the Guest turned Garraty's head from side to side, glancing over each shoulder at the empty subway car.

"Hello?"

—*Hi.*

"Where are you?"

—*Same place you are.*

Garraty usually occupied himself with his own thoughts during a transfer, allowing a Guest to go about his business undistracted. Today, he felt talkative. His long planned vacation to the Sierras, due after two more transfers, buoyed him. He could already feel the delicate flick of his wrist, redirecting a fly in mid-cast, the strike, the tug and the fight of a steelhead trout on the line. Fishing integrated a man, mind and muscle working together. If every Host in the Los Angeles section took up fishing, Garraty would guarantee a reduction in the number of crack-ups before retirement. Fishing saved Garraty from going sour more than once.

—*You like fishing?* asked Garraty.

"Fishing?"

—*Catching fish. Rod and line and hook. Here, fish. That sort of thing.*

"Who are you?"

—*Mike Garraty. Your Host.*

The Guest, pausing to think, scratched Garraty's head, a habit Garraty himself never picked up. Once in a while, a Guest's habit lingered. Motor skills and strong emotions, stimulants to physiological change, left residual traces. Garraty remembered enjoying the feel of a piano keyboard after a concert pianist visited Earth. He tried playing and succeeded, plinking out "Chop Sticks." On another occasion, hosting an eminent attorney—on Earth to argue the fate of a planet before the United Nations High Court—Garraty felt indignation for weeks after the case was heard, snapping self-righteously at his friends and condemning their apathy. He remembered pounding tables. A week fishing re-established Garraty's placid world view. Other Hosts reported similar experiences. Transfer, Inc. kept a psychiatrist on twenty-four hour call. Garraty preferred fishing to Freud.

The silence continued, accompanied by tension in Garraty's muscles, a condition Garraty sensed only at a distance.

—*Relax,* said Garraty. *You'll wear this old carcass out.*

"Old?"

—*Just a figure of speech. Let's get back to fishing. I remember once on the Klamath, a friend of mine and I—Willie Hanson, a short guy—You do like fishing?*

The Guest, busy testing Garraty's arms, tugging at the crossbar on the seat in front of them, ignored him.

—*You're still in control.*

The Guest stopped tugging on the bar. "You've been there all the time?"

—*Sure.*

"Are they all . . . that way?"

—*What way?*

The Guest groped for the word. "Inhabited."

The word amused Garraty. As far as he was concerned, Davis or Davies (Garraty had missed the name) was doing the inhabiting.

—*You don't want a dead body, do you?*

"No."

—*Then they're 'inhabited,' as you put it.*

The man's anxiety increased. Garraty's Guest seemed old. During the day, visiting several banks and negotiating a business loan for mineral extraction on a planet called Geros, apparently a world with no land masses and a water pressure four times that of Earth, Garraty noticed nothing extraordinary. Davis, or Davies, or whoever he was, comported himself like any business Guest, but the discovery of someone conscious in the borrowed body unnerved him. Young men adjusted quickly, glad for the company and occasionally asking advice. Garraty, himself a young man, never gave advice. Older men, discovering their conscious companion, seldom wanted company or advice, usually preferring to conduct their business and go home. Old men felt threatened.

The car rolled into the Century City station, platform lights flashing squares of light across the seats and car floor. The doors split, hissing into the sidepanels. Two men got on, walking to the rear of the car and sitting down. The doors closed and the train lurched, leaving the station.

"They should tell people," said Garraty's Guest.

—*They usually do. Can I make a suggestion?*

After several moments of hesitation, the Guest answered. "All right."

—*Don't vocalize.*

"What?"

—*Think what you have to say. If you vocalize, people will think you're talking to yourself.*

The Guest paused, thinking over the suggestion and its implications.

—You can read my mind.

—*Can you read mine?*

—No.

Garraty laughed.

—*The answer,* said Garraty, *is yes and no. When I verbalize, you're reading my mind.*

The car rolled through several more stations, stopping for passengers at each. Garraty was deciding how to bring up the subject of fishing, when his Guest broke in. For some reason, it reminded Garraty of a young boy he had once hosted, visiting relatives on Earth. Whenever the boy wanted to talk to Garraty, he broke in with "Pilot to navigator."

—May I ask a question?

—*Sure.*

—Why don't our personalities merge?

—*Personality has a certain integrity to it. Dual personalities don't merge either.*

The explanation seemed to satisfy his Guest, who remained silent for several more stops. When the car rolled into the Sepulveda Boulevard station the Guest stood up, preparing to leave the car.

They exited, catching a moving belt through a brightly lit tile tunnel. Garraty's Guest stood on the belt, letting it pull him.

—*If you walk with the belt, it's faster.*

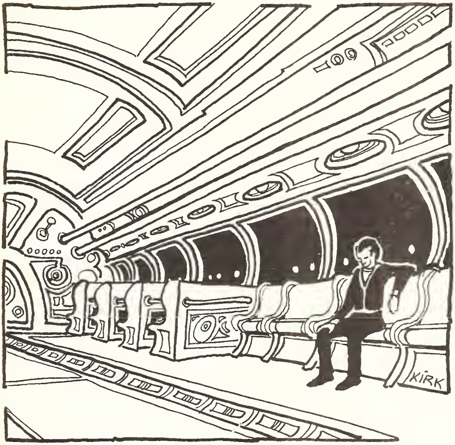
—Oh, I'd forgotten.

At the end of the belt the Guest climbed the escalator, taking the steps two at a time. Garraty smiled to himself. The more highly altered a Guest's natural body, the more he delighted in an Earth body. Garraty kept himself in condition to avoid any possibility of enthusiasm outrunning ability.

They emerged in the ticket section of Los Angeles Interstellar, a cavernous building with roofs as high as a shuttle hanger. Transfer, Inc., unfortunately for Garraty's frequent stock options, made few encroachments into commercial space travel. Transfer's clients, incapable of travel aboard ordinary spacecraft, constituted a separate market. United Nations policy on planetary settlement required a planet to remain roughly as it was found. If a world was habitable by normal human standards, it quickly populated. If it required substantial alteration to accommodate human beings, the human beings were altered instead of the planet. The policy was said to promote lasting human colonization. Instead of a planet being stripped of its valuables and abandoned—a frequent occurrence in the early days of space exploration—the population remained, matched to their world. The development of transfer allowed efficient, short-term travel from these colonized worlds.

Garraty's Guest approached a ticket

He was once a concert pianist, enjoying the feeling of a keyboard, and another time an eminent attorney, on Earth to argue the fate of a planet before the U.N. High Court.



counter, a transparent plastic desk enclosing several young girls. A tall blonde with a nametag reading "Louise" detached herself from the group and came over to them.

"May I help you?"

"I'd like to book first class passage for two from here to Hector in Alpha Centauri," said the Guest, depositing his passport on the counter.

Garraty, paying more attention to the blonde than the transaction, started at the sight of the passport. Transfer Guests never carried passports. The picture, voiceprint and genetic identification of someone else's body were of little use.

—Where'd you get that? asked Garraty.

No one answered. The girl inserted the passport endflap in a slot on the desk and asked the Guest to put his hand on a metal grill.

"When would you like to leave?"

"Tonight, if possible."

The girl said something to the computer input. It answered immediately, clearing a "Mr. Andrian" for the 2300 ship to Alpha Centauri.

—Who's Andrian?

The girl finished writing up the tickets, slipping them into a folder and handing them to the Guest along with his passport.

"You'll have to be here by twenty-one hundred to clear your companion. I hope you have a pleasant trip."

"Thank you."

—What are you trying to pull Davis?

They started toward the subway escalator.

—Have you ever been to Hector, Mr. Garraty?

—No.

—It's lovely.

Garraty tried again to talk to the man, without success. They walked down the moving escalator and along the belt to the subway, pausing to insert a credit card in the turnstile. Passengers filled the car, forcing them to stand. The more Garraty thought about his Guest's activities, the more they bothered him. Davies had given the girl a passport. She slipped the endflap into their computer and took a genetic reading off Garraty's hand. The computer cleared the reservations, indicating that picture, voiceprint and genetic I.D. matched the information on the passport, Mr. Andrian's passport.

They changed trains in Long Beach, picking up the South Coast monorail. The coastal cities of Orange County slid past, Seal, Sunset and Huntington Beaches identical below them. When they neared the Balboa Island station, the Guest stood up.

—Where we going?

They walked down the escalator and crossed a short bridge to the island, stopping to glance in the water.

—I hope you're not planning to jump, said Garraty.

—No. The water looks different.

—Looks the same to me.

—It's different than I remembered.

—It's just as wet.

On the narrow main street of the island, blocked off to all but foot traffic, they stopped at a public phone. Garraty's Guest carefully read the posted instructions before punching out a number. A child answered, her face round and tan on the screen.

"Hello."

"Hello. Is your mother there?"

"No."

The girl waited for the next question, stoic on the screen.

"Is anyone there?"

"Me."

Garraty smiled. Whoever his Guest wanted, a small, literal-minded obstacle stood in the way.

"Are there any adults there?"

"No."

"You're alone."

"No."

—Having problems?

"You are the only one there?"

"Except for gran'ma."

"May I speak to her?"

"No."

Two hands reached into the field of view, hoisting the girl out of her chair. The camera adjusted upward, stopping on a grey-haired woman with the child in her arms.

"May I help you?"

"I hope so," said the Guest. "I'm looking for a Mrs. Stewart."

"I'm Mrs. Stewart."

Garraty sensed confusion from his Guest. Reacting immediately, Garraty stabilized himself. Though normal sense data—sight, sound, smell and touch—came to him second hand, a Guest's strong emotions required protection. Crackups usually happened because of a Host who kept inadequate distance between himself and his Guest.

"Cynthia Stewart?" asked the Guest.

"Yes."

They planned a mining colony on the ocean floor, but U.N. policy said man must adapt to alien worlds, not adapt the worlds to man. They had the choice: outlaw mining, or adaptation, so McCann underwent a series of operations.

The confusion increased. Two words spilled over the threshold to Garraty—*so old.*

After a few moments, the feelings subsided. Garraty relaxed.

"I have to see you," said the Guest.

"Do you mind if I ask who you are?" inquired the woman.

"Who is he, gran'ma?"

"I don't know, dear. That's what I'm trying to find out."

"I can't talk on the phone."

"Then I'm sorry, young man—" She reached toward the screen, preparing to hang up. Garraty sensed desparation.

"Wait, please. It's about Ted."

"Ted," said the woman.

"Ted McCann."

—*Who's McCann.*

The woman's expression changed, losing its impersonal quality. "Ted McCann."

"Yes."

"You're a relative of his."

"Something like that."

—*Who's McCann?*

"All right, young man. But give me a few minutes to straighten up the house."

"Fine. Good-bye."

"Good-bye," said the little girl, waving.

The Guest hung up.

—*Who's McCann?*

—Quiet. I'm thinking.

—*Listen, Davies-Davis-Andrian—*

—McCann.

—*Whatever you call yourself, there's something fishy going on here and I—*

—I thought you liked fishing.

—*Very funny. I want to know what we're doing.*

—I think we'll have a cup of coffee and let Cynthia clean up. I haven't tasted coffee in fifty years.

McCann found a sidewalk cafe at the end of the street. Selecting a table near the pedestrian traffic, he ordered coffee, "strong and black." Morning shoppers passed on the sidewalk next to them. McCann took evident delight in the coffee, sipping it gingerly.

"Hot . . ."

—*Don't burn the lips.*

". . . but good."

—*I'm glad you like it,* said Garraty, disgusted. After this transfer, Garraty personally would make sure McCann never transferred again. Phony names, phony passports, phony everything.

Among the passersby, Garraty noticed Gary Westcott, his red hair and freckled face unmistakable in the crowd. Westcott, a Host in the Orange County section of Transfer, almost passed without recognizing Garraty.

"Mike?"

McCann gave no response, staring blankly at Westcott. Westcott's face took on a more formal air.

"Excuse me, Sir."

"Yes."

"My name is Westcott. I'm with Transfer, Inc."

Garraty felt McCann grow tense.

"What can I do for you?"

"The Host you're using is named Mike Garraty. I wonder if I could ask you to pass along his answer to a question."

"Certainly."

Westcott's face became animated, as if he were trying to communicate with someone at the bottom of a well and thought exaggerated expressions would help. It occurred to Garraty that Westcott must keep a greater distance between himself and his Guests than did Garraty.

"Mike. I made reservations at Moosehorn Lodge for the twenty-second. They've got steelhead two feet long!" said Westcott, holding his hands two feet apart. "Do you still want to go?"

—How come he can talk? asked McCann.

—*He's off duty. Tell him, yes, I still want to go.*

"He says he can't make it the twenty-second."

—*Hey! Tell him I* can *make it!*

"Why not?" asked Westcott.

"He says he'll be out of town. Something about a girl."

Westcott smiled. "A big one on the line. Thank you, Sir. I hope you enjoy your stay on Earth."

Westcott left, disappearing into the crowd.

—*Listen, whatever your name is . . .*

—McCann.

—. . . *I've been planning that trip for a month!*

—You'll be out of town.

Garraty tried to pursue the subject. McCann, mute, finished his coffee, paying and starting down the street. After a block, McCann picked up the pace, inhaling deeply.

—A fine sea breeze, said McCann.

—*Wonderful.*

They reached a three-story residence, fronting on the channel, a late twentieth-century structure, remodeled to accept modern conveniences. McCann went up to the front door, rapping on it with Garraty's knuckles.

—*No one home,* said Garraty, hopeful.

The woman answered with the child in tow.

"There he is, gran'ma."

"Yes, dear. I see him. Won't you come in."

They went into the livingroom, a wide comfortable room with a view of the channel through one transparent wall. Two sloops, striped spinakers puffed, were running down the channel.

McCann sat on a low couch near the picture wall, leaning forward and resting Garraty's forearms on his knees. The woman sat in an easy-chair opposite them, lifting the child into her lap. Once settled, she looked up at McCann, her expression courteous and expectant.

"You said you had word from Ted McCann."

"I do."

"I haven't heard from him in—let me see." She gazed past them at the channel outside, searching her memory to count

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RADIO ASTRONOMY TODAY

The giant 250-foot diameter radiotelescope at Jodrell Bank in England Is an excellent example of the new tools astronomers have developed since the end of World War Two.

article/**Jay Arrow**

The radiotelescope used by the U.S. National Bureau of Standards was specifically designed to study solar radio signals.

One of the first uses found for the magnifying properties of ground glass was the examination of the heavens. Man didn't turn his eyes to the skies—they had been there since the dawn of history—but he did immediately engage this new tool, and for hundreds of years the telescope was the key instrument of the astronomer. Innovations were made—such as the in-introduction of photography, giving images which could be studies in the leisure of a laboratory, rather than brief hours of direct viewing, and spectroscopy, which made it possible to both tell what objects in space were made of, and, eventually, to determine movement in relation to Earth—but these were adjuncts to the telescope, not basic changes in astronomical procedures.

Then, during the late 1920's and early 1930's, one man, and, perhaps significantly, not a astronomer, opened up a whole new method of viewing the heavens, with a radio, rather than with the eye or a camera. Karl Jansky, a researcher at the Bell Telephone Laboratories, was assigned the task of finding out why a steady hash of static was forming a background to trans-ocean radiotelephone operations, and to eliminate that static.

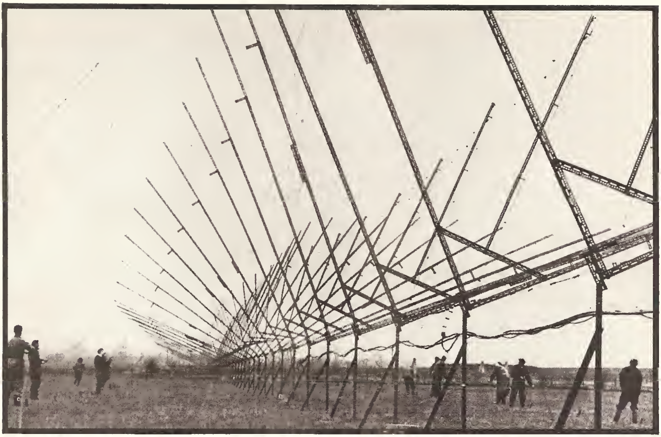
Unfortunately, none of the normal methods of tracing down static sources seemed to work, so Jansky built himself a moveable radio antenna some 60 feet long. He carefully rotated the antenna and recorded all the data on the signals it was receiving, and was astounded to discover that the radio noise he was trying to track down was coming from the sky, from the direction of Sagitarius, from the center of our galaxy! While this may seem to be a very significant development to us — as indeed it proved to be — to Jansky it was just the answer to a problem. He has been asked to find the source of the static. He had. He had been asked to eliminate the source of the static. He couldn't. End of problem. Shortly after publishing the results of his work he went on to other problems, leaving the development of radio astronomy to others.

Where Jansky left off, a young amateur took over. Grote Reber, a radio manufacturers employee, read Jansky's findings and decided to get into radio astronomy. By 1937 he had built himself a 31-foot diameter antenna out of sheet metal in his backyard, and had confirmed all of Jansky's findings. He was able to not only confirm that the center of the galaxy, forever hidden from optical astronomers by clouds of dust, was a strong radio source, but was able to map several other radio sources in the sky, several of which did not correspond with any visible objects. Unfortunately, his findings were first published in 1940, and the world was a bit too concerned with what was happening in Europe and soon-to-be-happening in the Pacific to pay much attention to a report on radio noise from the sky.

Even though astronomers weren't able to do much about radio astronomy during the war years, they read Reber's reports, and made plans. Soon the war would be over, and when it was radio telescopes would be erected in widespread locations around the world, and astronomy would receive a shot in the arm of knowledge the likes of which hadn't been seen since the invention of the optical telescope.

Since those early days radio astronomy has grown up with a vengence, going from an idle curiosity to a possible tool to a full-fledged partner of classical optical astronomy. Looking beyond the solar system the radio astronomers have mapped the great dust-clouds which fill the spaces between the arms of our galaxy, and, more importantly, since radio waves are not blocked by those dust clouds as are light waves, the radio astronomers have been able to accurately map much of our galaxy, instead of only our limited local area — all that was available to the optical astronomers.

As easy as it is for astronomers, or even radio amateurs, to hear the noise made by distant stars and galaxies, to accurately locate those objects in the sky takes tremendously sophisticated equipment. From signal amplifiers to dish and dipole antennas, the radio astronomer's equipment would make the richest and most avid hi-fi nut or



The half-mile-long dipole antenna used at the Mullard Radio Observatory in Cambridge, England covers 2 acres of ground.

radio ham turn green with envy.

The biggest piece of equipment, and the piece which comes immediately to mind when one thinks of radio astronomy, is the antenna. Basically there are two types of antenna — the dish and the dipole. Most often shown is the dish antenna, the impressively big bowl — actually a shallow parabolic radio-wave mirror which collects a radio signal from space and bounces it back, concentrates it, at a collector antenna at the center of the bowl. The principle advantage of the parabolic bowl or dish antenna is that it is steerable. They can be turned to follow a signal, or to a series of signals at short intervals. Another great advantage of the dish antenna is that it can be "tuned" to receive different wave-length signals. And there is one originally unexpected use for the big dish antenna. With only minor changes a signal can be broadcast *through* the antenna. Specifically, the unit can be used as a radar wave broadcaster and receiver, pinpointing with great accurancy the position, and through subsequent fixes, the course, of spacecraft either orbiting the earth or on their way to or from the moon.

The greatest drawback of the dish antenna is the cost of construction. The largest fully-steerable antenna is the one built several years ago at Jodrell Bank, near Manchester, England. With a dish diameter of 250 feet, the Jodrell antenna can either map the sky or track spacecraft with a degree of accuracy unmatched by any other installation, including the NASA tracking station at Goldstone, California.

Larger than the Jodrell antenna, but only partially steerable, is the 300 foot diameter unit built at Green Bank, West Virginia. The largest of the dish antennas, though, is the 1,000 foot monster built in a natural bowl near the town of Arecibo in Puerto Rico. Completely immovable, the 19 acre steel mesh antenna can map whatever portion of the sky it happens to be pointed at with an accuracy, and range, no other antenna can match.

While the dish antenna amplifies stellar radio signals by collecting and redirecting them at a central antenna, the dipole-type is a literal forest of small, identical antenna which collect the signals from the sky, then each individual weak signal is fed into a common amplifier, the many weak signals making one strong signal. The dipole is generally as effective as the dish antenna at collecting radio signals from space, but, because of the fixed construction of the many small poles, the dipole array is able to collect signals of only a single wavelength. But their big advantage is that dipoles are easy to put up, construction costs are low, and several thousand dipole antenna can be built, spread out over miles of land, and when this sort of antenna is built it is virtually impossible to match its accuracy in recording radio signals from space in the particular wavelength it was built for. A few of these dipole

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article/James Benford

PROJECT CYCLOPS

JAMES BENFORD, now 32 years old and the twin brother of Greg Benford, received his Ph.D. from the University of California at San Diego, then went into the then-new field of relativistic electron beams. Since that time he has been doing research on the application of those beams to controlling thermonuclear reactions—what he refers to as "the fusion problem"—as Senior Physicist, Beam and Plasma Research Department, Physics International Company. His major interests, aside from his work, are mysticism, rock and "reality," with his heros being Albert Einstein and George Harrison.

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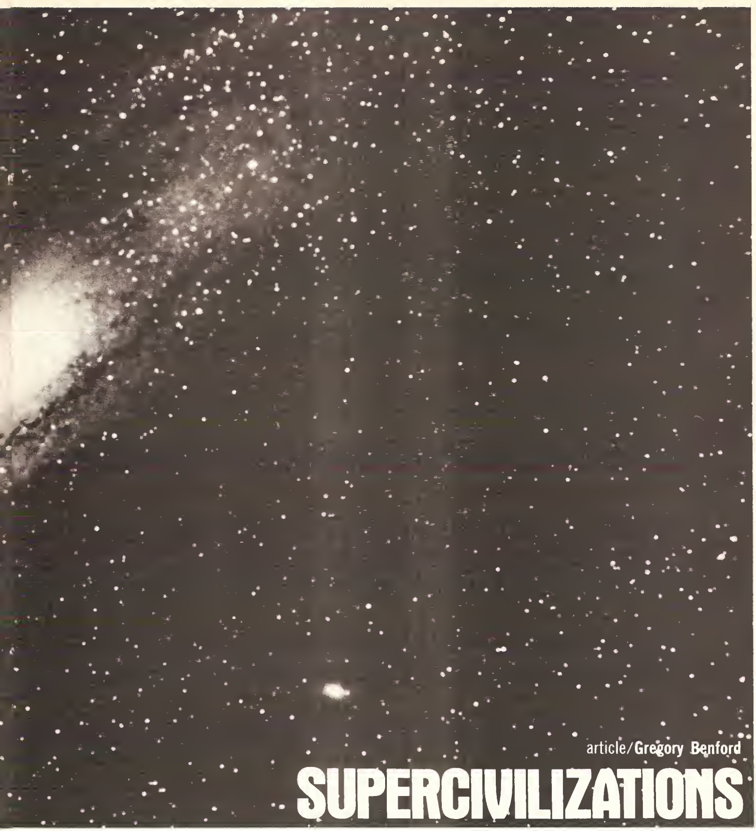

article/**Gregory Benford**

SUPERCIVILIZATIONS

GREGORY BENFORD, also 32, received his Ph.D. from the University of California at San Diego, then went into research while holding the position of Associate Professor of Physics at the University's Irvine Campus. He is currently engaged in research on controlled thermonuclear fusion for the Atomic Energy Commission, and describes himself as a theorist, as opposed to his brother, whom he refers to as an experimentalist. He has had two science fiction novels, 30 short stories, and many science articles published, and is the coauthor of the forthcoming textbook, "Astronomy and Life in the Universe."/*turn to page 51*

PROJECT CYCLOPS

As you read this, a message from an intelligent alien species may be arriving at the Earth and passing on unheard. And now a NASA study has shown that using present technology we can construct a system which will intercept any communication coming our way and therefore demonstrate the existence of extraterrestrial intelligent life. And this will cost a fraction of what it took to send men to the moon.

These messages, of course, are contained in radio waves, one of our older technologies. When Marconi began broadcasting 75 years ago, it wasn't generally recognized that by generating such signals we, in fact, had sent a birth announcement for mankind streaming outward in an ever-expanding wave, putting ourselves on a new and gigantic stage. Radio is such a far-reaching method simply because a transmitter broadcasts in a small part of the spectrum and, for some frequencies, suffers little attenuation or interference in the interstellar spaces. Radio astronomers have long realized the possibilities for interstellar communication which their discipline holds, but only with the advent of Project Cyclops has the concept reached an advanced formulation.

Project Cyclops was formed in 1971 to produce a design study for a system for detecting extraterrestrial intelligent life. Of course, the subject has been studied before, and even one radio search of nearby stars, Project Ozma, has been conducted. Cyclops represents the first programmatic effort to define the optimum system for intelligent radio emission searches and to develop a systematic search strategy.

The rapid unfolding of the biological and physical sciences in the last decade has led to the widespread belief that habitable planets are a common occurrence, in contrast to earlier pessimistic estimates. Planetary systems appear to be the rule rather than the exception, because they form out of the swirling gas cloud from which the star itself condenses. The organic molecules from which life derives have been found in space, so it seems likely that if a planet forms at an appropriate distance from the parent star, life will result. Intelligence appears to confer survival value, so natural selection will favor the development of beings which can modify their environment, and eventually create high technology.

Therefore, it seems likely that other intelligent life forms at our stage of advancement would have generated their own expanding sphere of radio waves, which we could detect. They might also reason as we do and eventually attempt to communicate by constructing a powerful radio beacon. How we should respond to this possibility can be debated: do we broadcast or listen? Even those who fear invasion from space (out of ignorance of the vast distances involved) can't object to a strategy of listening, since it doesn't reveal our presence. By the way, anyone who really fears invasion should advocate that we cease broadcasting TV, or convert to cable TV or satellite broadcasts, which don't radiate as much as our present systems.

The crucial question is just how many fellow civilizations are around, because this determines how large a detector we would need for listening and how large a beacon we would need if we decided to send a message ourselves. Since only heavy-element stars have the necessary materials for life-forming chemistry, the answer is closely related to the occurrence of these stars. Recent research on stellar evolution during the history of our galaxy shows that these stars were condensing out of interstellar material in greater numbers in the early days of our galaxy than they were when our sun was formed. Therefore, if we assume that the time it took for technological civilization to develop on Earth is typical (about 4.5 billion years), *advanced technological societies have existed for five to six billion years.* How many exist now depends very much on the survival value of advanced technology. Lately it seems to have reduced our chances of long-term survival.

One may also argue that truly advanced beings may not wish to communicate with primitives such as ourselves, which is equivalent to their not existing at all. But one conclusion is clear: unless societies live for billions of years, the number of such societies is now *less* than it was several billion years in the past. This is because most of the stars were formed before our sun and most life would have evolved before ours. Consequently the cosmic radio society should be well evolved, and all we have to do is listen in. The same fact also gives us good reason to expect to detect beacons around some of the older stars. Just as men wish to perpetuate themselves past their deaths through their creations, societies may wish to preserve their achievements or simply to be remembered. Therefore they should be eager to transmit their heritage to us and will construct powerful radio sources to pass it on.

In any case, interstellar communication is probably a reality for many races right now. In fact there's probably a great deal of activity going on in the dense regions near the galactic center. Looking for this galactic community would require a sustained effort over decades with the most advanced detection equipment we could muster. This detection system would be called Cyclops, although it resembles a giant ear more than an eye.

The proposed Cyclops system is an array of radiotelescope dish antennas, each a hundred yards in diameter, covering a two mile diameter area and phased together electronically to act as one huge dish. The system can be gradually expanded from an initial core of antennas to increase its detection range. The range of the full system would be 1,000 light years. In comparison, the Ozma search, which actually investigated

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SUPERCIVILIZATIONS

How far can we go?

Cities are growing faster than ever, but can they go on indefinitely? Science fiction has already painted somber portraits of giant future cities with awkward names like BoshWash (Boston-Washington) and SanSan (San Francisco-San Diego). There seems nothing to stop urban sprawl, and little will to resist it.

Man is wedded to the city. We began with villages and rude huts, perhaps 10 or 20 thousand years ago when agriculture was invented. The first motivation for cities was utility in tending crops, better distribution and simple self defense against roving tribes of hunters and nomads. From there it was a seemingly inevitable progression—to villages, to towns, to cities and finally to urban complexes, the jumbled sprawl of man's nesting places.

In a way it seems odd that we have so quickly gotten into such smog-choked, forbidding and hostile circumstances. But man seems driven into cities by quest of community and variety, against all his natural instincts that favor open land and free sky. Sociological research has shown that people prefer spots that are at the boundary of natural areas—at the edge of a forest, the foot of a mountain or a shore of a body of water. This isn't surprising, because such a place afforded our primate ancestors many avenues to escape to or hide in, and made a lookout's job easier—no need to search in all directions at once.

The surprising point is that people violate this natural preference by moving into crowded cities, where everyone must live in his neighbor's pocket. Apparently the drive for variety and spice overwhelms our earlier motivation. But as social turmoil testifies, we pay a high price for the luxury of the city.

We have two inheritances, a biological and a cultural, and we are at the mercy of both. When they conflict, the result is widespread discontent. Often it is obvious that we need only act more sensibly to solve our collective problems, but we simply don't know how to live any other way.

It seems that ecological issues will eventually stop city growth, but even this may not be so. Some scientists have looked at the dramatic growth of cities and concluded that this is a fundamental feature of any technological civilization. Not merely of human civilization—that much is obvious—but also of alien societies circling other stars.

The Soviet astrophysicist N. S. Kardashev has suggested that, when we look for older, alien societies we can classify them by their size and energy use. This seems reasonable to Kardashev, because it appears unlikely that large cities could be made without sophisticated energy resources. The connection between size and energy is alarmingly obvious to us, because the United States faces a monumental energy crisis in a few decades. Kardashev makes three classifications:

TYPE I CIVILIZATIONS control the energy sources of their planet. Within a few decades we will enter this class, if we master controlled thermonuclear fusion.

TYPE II CIVILIZATIONS use a large fraction of the sunlight from their parent star. These societies were first examined by the American physicist Freeman Dyson.

TYPE III CIVILIZATIONS control the resources of an entire galaxy.

The difference between Types I and II or between Types II and III is a factor of about 10 billion in energy use (power). This is a huge number, but a society growing at the rather modest rate of 1% per year will go from Type I to Type II in less than 2500 years. Going from Type II to Type III will take longer, since it requires the race spread out among all the stars. Possibly this could be accomplished within a hundred thousand years.

Type I civilization resembles ours. The only method for detecting them in our galaxy is through radio or laser beams. Harvesting all the energy available on a planet is not a simple task. Basically, nearly all energy comes from the sun. Coal and oil represent stored forms of energy absorbed by plants billions of years ago. Water hoisted by the sun's ray falls downhill, to drive hydroelectric plants. Winds blow and drive wind mills, because solar heat falls unevenly on the earth's surface.

Fission and fusion reactions make possible the "burning" of uranium and hydrogen stored in the planetary crust. Earth's uranium reserves will vanish within a few centuries. Fusion power—made by burning a particular hydrogen isotope found in our vast oceans—can sustain our power needs for about 10,000 years. Eventually, even this source of energy will run out. In the long run, only solar energy will remain. If other civilizations maintain technology for as long as 100,000 years at our present level, they must turn to their own suns for energy. Over millenia, no power source but the sun can grow to meet a steadily increasing demand. The rate at which the sun emits energy is the ultimate limit on human technology, and presumably on others as well.

This leads us to Type II Civilization. How could we—or anyone else—possibly capture most of the energy from a star? By making a vast swarm of particles which orbit the star and collect most of its light. The swarm itself is made up of the matter from planets, redistributed into small, asteroid-sized objects. This "Dyson sphere" could be made from the mass from one planet such as Jupiter. Picture in your mind a swarm of solar cells, forming a thin spherical shell about as far from our sun as the earth is. If they were efficient collectors, and about a mile on a side, they could intercept and use all the sun's radiation if there were 360,000 of them.

Of course, breaking up Jupiter and

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only two nearby stars, had a sensitivity four million times weaker. Cyclops will search a frequency band two million times broader and will do it in only ten times the observation time.

At the center of the array would be a processing and data reduction center. The incoming signals would be frequency analyzed and combined in various ways. Here is the element which makes Cyclops unique. Very advanced signal detection techniques will be used. For example, any signal would be Doppler shifted in frequency by the motion of the planet upon which the transmitter was located. When the total received spectrum is displayed, any given signal will stand out at its emission frequency plus any Doppler shift. As the source revolves and orbits its star, the spike will change in frequency and move left or right on the spectrum display. If we take displays at several times and overlay them with suitable left-or-right displacements, all the individual spikes will add up. Any noise will tend to be cancelled out by this process so that very weak signals can be detected.

One difficult choice is where to look in the radio spectrum to locate a signal. There are so many possible channels for one to use; what is a reasonable frequency? Here there is a clear favorite. At wavelengths greater than 21 centimeters, the natural background emission of the galaxy increases; just below it the atmosphere begins to absorb much of incoming radiation.

Therefore, at about 21 centimeters there is a minimum of interference. Luckily the spectral lines of hydrogen and hydroxyl (HO) lie at either side of this quiet radio zone. These two disassociation products of water bracket the obvious choice for a communication place, a "water hole" for the meeting of water-based life. But even this selection leaves over 200 million channels to explore. The Cyclops system would provide a receiver with a billion channels, all operating simultaneously, with which to listen. The technology necessary for this degree of discrimination is now available, although it hasn't yet been applied to this problem.

The Cyclops site itself poses a problem because its requirements are difficult to fill in the U.S. The site must have geological stability so that the array will not require frequent precise realignment. The humidity must be low because the microwave radio signals would be disturbed by any sizeable differences in water vapor content in the air. Since antenna surfaces can be eroded, and winds and snow can deform surfaces, a calm, mild climate is preferred. Phasing of the array of antennas is much easier if the site is reasonably level. Since Cyclops is a detector of extreme sensitivity, external interference from TV and other man-produced radiation should be minimized by locating in an area remote from cities and air routes and surrounded by mountains. Since the array is highly directional and will pick up signals from a very small area of the sky, man-made signals will be selected against. But the system is designed just for such coherent signals, so careful shielding is important. Adding up all these requirements, the southwestern U.S. seems a likely candidate.

The Cyclops System would be useful from the time the first few antennas were constructed. A preliminary search of promising nearby stars would shake down the system. In about ten years, a hundred thousand stars would have been investigated with a gradually expanding array. This construction phase scan would search out to about 500 light years. The completed Cyclops system could extend that to about 1,000 light years (our galaxy is about 100,000 light years across). In total, over a million stars are within the detection range of Cyclops. Calculating just how long we need to search nearby stars for neighbors isn't easy, but estimates of the probability of advanced civilizations existing simultaneously with ours in a communicative state say that with an advanced system like Cyclops roughly 10,000 stars are likely to be enough. Since the antennas will begin operation as soon as a few are erected, this number of stars would actually be searched by about three years after the construction starts. One good place to start looking is in the direction of the galactic center. The galactic superculture may have constructed a beacon at the center of the galaxy, simply because it's a natural focus, a single point we all have in common. This is much like the choice of 21 centimeter wavelength because it is so closely associated with water-based life. But these estimates could be off. If the search revealed no beacon (or even a leakage signal from TV), we would then face the decision of whether we should construct a beacon of our own. After all, not everyone can be a listener.

One of the most interesting and most recently discovered types of astronomical objects is the pulsar. We now believe that these are rapidly spinning neutron stars, the remnants of supernova explosions. Now that the dozen or so most prominent pulsars have been discovered, very few more are being located. They are hard to find because we don't know in advance their pulsing frequency, where in the radio frequency band they're located and, of course, where they are in the sky. But pulsars are just the sort of organized signal that Cyclops is designed to detect; it could efficiently locate the estimated 10,000 pulsars in this galaxy. It could even find pulsars in other galaxies, which would tell us if the evolution of stars proceeds the same way there as it does here.

What would all this cost? About six billion dollars, spread over ten years, or six hundred million dollars a year. Cyclops would be the most expensive scientific instrument ever constructed but still doesn't approach the twenty-five billion spent for the lunar expeditions. Another way to look at this

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manufacturing solar cells from it would be the greatest engineering feat ever contemplated. Just keeping the small worlds from hitting each other seems a daunting task, to say the least.

However, Dyson emphasizes that nature sets few size and scale limits on the activity of an expanding technological society. If a civilization wishes—and that is the crucial point—a society may expand to the maximum extent permitted by the laws of physics. In our ordinary lives, we are used to asking not only whether a job is technically feasible, but also whether it is economically feasible. As Dyson points out, economic feasibility requires that resources of equipment and power actually exist. All human experience is with projects with short time scales (a few decades or so), where economic considerations dominate. But if we allow thousands or millions of years—what then?

If a society expands at all, the necessary industrial base for making a Dyson sphere can be created by growth of the economy, as the project goes on, provided only that raw materials of matter and energy are available. The race which attempts such engineering feats must be stable, gradually expanding and in need of progressively larger doses of energy. Our civilization is manifestly such an energy-addict.

In the Dyson view, the only limits to technological growth of a society are internal. A civilization—whether our own or an alien one around another star—can always decide that it has enough population, and the time has come to relax. Many societies may make this decision, or have it made for them by stagnation and decline. But if there is any society which keeps its strong expansionist drive, gradually and inevitably it will convert from a Type I civilization to Type II and perhaps onward, to Type III.

The magic ingredient here is time. Given any expansion, time alone will bring a society to Gargantual limits.

The interesting point in all this is that if only a few Type II or Type III civilizations exist, we may be able to see them. After all, the "Dyson Sphere" will heat up like asphalt pavement on a sunny day. Visible light comes from the star, is absorbed, then is reemitted as heat (infrared). These heat rays are another form of radiation, with longer wavelength and lower frequency. This waste heat can't be avoided. Our own Earth discards a lot of the energy received from the sun by radiating it away into space.

This was the thurst of Dyson's thesis—an old civilization would surround its star, sopping up the starlight, and look to us like an intense infrared object. So, Dyson suggested, use infrared telescopes to scan the skies. Not every infrared object would be a civilization, of course, but any Type II civilization would be an infrared source. This would aid in spotting suitable targets for further studies by radio telescopes, in hopes of picking up artificial radio broadcasts. Not only that, but simply by realizing that waste heat is the inevitable signature of a runaway technology, we make it more likely that we will recognize one when and if we spot it, even if by accident.

Many infrared stars have been found since. Some of them are "cocoon stars"—a star hidden in a cocoon of dust. They are often found in regions of space near brilliant, new-born stars—for example, in the great nebula in Orion. These stars are young, and the cocoon seems to be a short-lived phase in the process of stellar birth. But these stars are radiating hundreds or thousands of times as much energy as our sun. They are far too young and active to support an inhabited planet, because life simply would not have time to evolve near them.

If a Type II civilization lives near ordinary stars, like our own, their infrared radiation will be a hundred times fainter than the objects astronomers are now studying. Such faint sources have not been considered yet, because the instinct of astronomers is to look at the conspicuous objects first. There will be plenty of time later to make a long list of dim, infrared sources. There are many of them, and it is tedious work indeed to keep track of them. It will be many years before a complete catalog exists. Perhaps a Type II civilization will appear on this list, but distinguishing between the infrared emission of a civilization and that of stars or dust clouds requires much more knowledge of astrophysics than we now have.

Dyson's feats of planetary engineering seem remote and unbelievable, but we must remember that we are dealing with other societies and other minds. If only a small fraction of all extraterrestrial societies opt for the Dyson solution to over-population, we can still see them. They may be disguised among a host of infra-red stars, but by checking them for intelligent radio signals we can single out the Type II civilizations.

By contrast, a Type III civilization should be conspicuous. Looking for one in our galaxy has been likened by Dyson to "searching for evidence of technology on Manhattan Island." A galaxy contains vast exploitable resources of matter and energy, so we should expect a Type III civilization to eventually make immense numbers of infra-red sources. Some alien societies in our galaxy, born in the distant past, might have grown to this stage by now. We could expect great emission of radio and infra-red radiation, but other than this we have only very vague ideas about what a Type III civilization might resemble. Certainly, if a Type III society has overrun our galaxy with ruthless efficiency it should be very noticeable. Instead of wastefully shining all over the Milky Way, starlight would be carefully dammed and regulated. Obviously, this hasn't happened.

A lesser category of Type III civilizations—those which use only certain

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THE STARS HAVE ALL GONE OUT

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Winslow's gaze, directed absently at Humphrey, was glassy with thought as he pondered the practicality of that last statement. "You have a point, yes," he said at last, and nodded thoughtfully. "Five hours, you say?"

"I could reduce that to four," Humphrey suggested.

Winslow considered this. "I'm sure you could Parmenter. But what about the clerk handling that other day now? Have you thought about that?"

Humphrey did not hesitate; he had had this committed to memory long before today's forecast. "No problem there, Mr. Winslow, none at all. I happen to know that one of our junior clerks, Dave Emanuel, has been trying to secure a transfer down to computer control for quite some time now—he has an Operations & Wiring Certificate from MIT, you know—and I think I could take over his work very easily. And control is severely understaffed these days."

Winslow appeared almost amused. "Is it?"

"Uh—yes, sir." Embarrassed, Humphrey added diffidently, "At least, that's what I hear."

Winslow was staring at him cautiously.

"In effect, then," the supervisor said carefully, "what you are suggesting is not one promotion, but two."

Humphrey summoned up the mental image of the forecast card once more, but by this time he barely needed it. "Yes, sir," he said firmly. "it would be more efficient that way, I think."

Bertram Winslow knotted his face in a thoughtful frown. To Humphrey's unbounded—and highly visible—relief, in the next moment he nodded in sage agreement.

"Yes, it would be, Parmenter," he conceded, "and the only reason we haven't kicked Emanuel downstairs yet is the problem you've just obligingly solved, a replacement. Oh, there are thousands on our waiting lists, of course, but it takes so damn long before a new man becomes even reasonably adept at feeding and filing. We can't afford that, Parmenter, though we can afford one less computer technician down in control. Happily, you've removed that snag." He sat back in his chair, eyed Humphrey carefully. "We'll try this on a trial basis, then, and if it works out, we can make it permanent." He smiled wryly. "That makes you an executive, Parmenter, for what it's worth. Usually not more than a few dollars extra and the privilege of being given a security check; government policy says we have to run one on all workers in executive positions, so if you have any skeletons in your closet either throw them out pretty damn fast or forever hold your peace."

Humphrey tried to keep the edge of pride from his voice as he said, "No skeletons, sir. Fine with me."

"Good. And don't sound so damned proud of yourself— we would have gotten around to the same move, eventually. The stars look after their own, you know. All right, grab some lunch and be back at one. You'll start your new load tomorrow."

STARCOMP MANHATTAN—INTEROFFICE MEMO
FROM: *Bertram Winslow, Sagittarius Supervisor*
TO: *Richard A. Hennesey, Taurus Supervisor*
25 Oct 2068
Dick:

Enclosed this memo find desired data on Sagittarian executive employees, Manhattan Construction & Development Corp. Also PlastCon, Inc., Synthetics Ltd., and Intercity Development. Figured you could send it all up in one neat package to Lovell. Looks like an easy mark from here: MC&D is most likely to sub-contract for that four-billion Jersey renewal project to PlastCon and Intercity, both of which are run by the staunchest assemblage of Sagittarians in the city; appropriate astral dissuasions from linking up with MC&D therefore should not appear too suspicious, since the stars look down upon them both with equal favor. All of which leaves us free to push MC&D over to Synthetics Ltd. and that fifty-one percent ownership of ours. So how come with so much gold pouring into the government coffers I haven't had one goddamn raise in over seven years?

Which reminds me—Aggressive little Tauran down here bucking for a promotion to senior file clerk. Think you can swing a short bio on him? Bureaucratic crap, I know, but we must satisfy regulations, find out if he's a member of the militant Astronomers or something and if he is how the hell would we find out? Have to run one on an Aries transferring down to control, too. Neither one seems the bomb-hurling type, but . . .

Back to you soon, I hope. Christ, I need a vacation. (I know, I know—it's not in the stars. Go to hell.)

Best,
Bert

25 Oct 2068: Parmenter Gloria L: A turn in events may not be the answer you seek, but roll with it, ride with it, work with it. There is always hope.

Well, that's fine, Humphrey," Gloria said, her voice pulled taut in self-control, as a consequence unnaturally high and thin. "It's what you've waited for, after all."

Humphrey frowned uncomfortably. The living room swam in a current of broken dreams and shattered promises, shards of both carried swiftly by the tides of sudden hate, nicking the two drowning humans who fought to survive in its murky depths. Humphrey had not wanted this confrontation, but saw it now as unavoidable; it was as inevitable as Gloria's twisted interpretation of his fortune as her misfortune. Nothing concrete had yet been voiced, but that was purely perfunctory; the hostilities existed, solely on her part but they existed, and words could hardly heighten their intensity. Humphrey held a vague hope that words might perhaps soften the wall of emotion which had arisen between them; and still working from the forecast-induced confidence of the morning, he elected to make the attempt.

Gloria, her back turned toward him, was silent. Humphrey could not see her face, but could imagine the spectrum of emotions flickering across it: disappointment, frustration, rage? His hand went out to her; an almost imperceptible shiver passed into his fingers upon contact.

"Gloria . . ." His voice, stiff and condescending despite his best efforts, seemed only to pull her nerves tighter, to send her further down that river of hate than before. "Gloria, it's not what you think. Really it isn't."

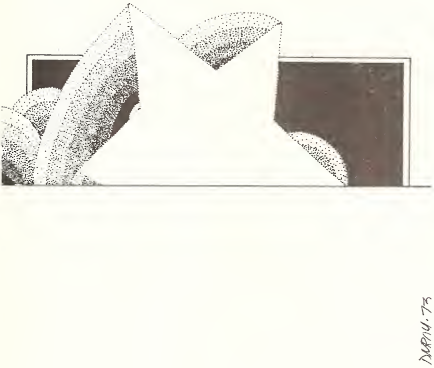
Gloria turned, a grotesque half-smile pasted carefully onto her face. "How would you know what I'm thinking, Humphrey," she said quietly. "We don't have that kind of communication, do we?"

Her frighteningly calm tone shocked him, her sardonic grin repelled him. For a moment Humphrey felt lost, felt like falling back on his standard reply—It'll come, Gloria, it's our due—found that that escape was denied him; *his* due had come, and by the gods of all stars he could not share it with Gloria.

Lamely, he said, "We can still have it, Gloria, I promise. We can still try."

Gloria shook her head savagely. "No, we can't," she said bitterly. "You have your dream. You're a success. A goddamned success. I suppose that's important to you. But not to me, Humphrey. You've used up what little hope the stars gave me. It's gone now, all of it . . .

"It'll come, Gloria," he would say, each repetition causing the words to fade just a little more. "It's our due. The stars look after their own." Then Humphrey would be alone once more, waiting. Always waiting.



all that I'd been raised to hope for, to want, to need. I'm not very remarkable, Humphrey; I've never wanted to *be* anything, someone of importance, crap like that. I just wanted to know someone as well as I know myself, to have a love just a *little* better than anyone else. I searched for someone who could give that to me, Humphrey. I thought you could." She lost her grin abruptly to a blank, feelingless mask betraying nothing of the pain behind it. "I suppose I was wrong."

Humphrey took hold of her shoulders, looked searchingly into those suddenly-fireless, suddenly-tired eyes. "You're talking nonsense, Gloria," he said, at once aware it was the wrong tack but no turning back, no turning back. "I didn't take your dreams from you, I merely fulfilled mine. You still have yours. You're as much a Taurus as I; you have that same promised peak of happiness. We can still have that rapport, Gloria, if you'll only just try."

The corner of Gloria's mouth twitched into that obscene smile, that accusation, that damnable thing that sent Humphrey farther and farther away from her.

"You're a fool," she said simply. "A goddamn fool, and you don't even know it. Can't you see—your success is my success, your dream is my dream, whether I want it or not. That damned promotion of yours will take us out of this hole in the wall, maybe out to the suburbs. Status. Well, fine. I've wanted status, too—but only secondarily. But now that's all I'm going to get." She twisted quietly from his grip.

"All right, forget the stars," Humphrey heard himself say. "We can build that rapport ourselves, alone, without them."

She looked up into his face, a softer but no less mocking smile on her lips. "Forget the stars?" she said. "Can you really forget the stars, Humphrey? Aside from the fact that it's against the law—could you really ignore them, live, work, and love without them? Could you, Humphrey?"

The maelstrom of the room washed violently over him in a black tide. Humphrey began to say, "Yes—," found himself checked by himself, by an inner voice that repeated Gloria's question to the point of unbearability: could you? could you? could you?

Gloria's smile did not fade. It flourished in the dark silence.

She was alone in the bedroom by the time the living room had returned to normal. Humphrey stood weakly in its center, vaguely wishing for the first time that it was windowed. So he could see the stars. And hating himself for wishing it.

STARCOMP MANHATTAN–INTEROFFICE MEMO

FROM: *Richard A. Hennesey, Taurus Supervisor*

TO: *Bertram Winslow, Sagittarius Supervisor*

17 Oct 2068

Bert:

The hell with MC&D. Enclosed this memo find requested data on one Humphrey Delaney Parmenter, employed February 2053 to present, Sagittarius Section StarComp Manhattan as junior file clerk in charge of November 29th, under the dubious supervision of Bertram R. Winslow. The data, in case you do not care to wade through it all, is paraphrased thus:

Parmenter's astral identification card #290-643-788, reproduced in every business transaction the man has made in the past forty years and submitted to StarComp, I presume, at birth, gives his birthdate as 21 May 2025, Taurus on the cusp: his life has been shaped accordingly, molded to Tauran standards all the way. For verification we tried to grab hold of his birth certificate, but had to settle for a photocopy from the Hall of Records in Tarrytown, New York, given as Parmenter's birthplace:

The certificate, or at least the copy, gives his date of birth as 22 May 2025 . . . which, last time I looked, was Gemini on the cusp.

Clerical error? We thought so at first. Then we did some additional checking. A lot of additional checking. Bert, this department hasn't had so much legwork in years. Parental background runs as follows: mother, Frances L. Parmenter, formerly Frances Louise Delaney, born 14 August 1986 in Tarrytown, New York. Father, Walter W. Parmenter, born 18 July 1982, New York City. Married March 2006. Parmenter a salesman for firm in upstate New York, .absent from

Humphrey pushed himself away from the desk cluttered with paper lives cut from paper dreams by paper men. It no longer mattered; that was all behind him now.

home for long periods of time, ostensible explanation for late arrival of subject, Humphrey D. Couple divorced September 2026; granted on grounds of adultery on the part of Walter, the Traveling Salesman. Charged paramour, one Sylvia Watkins (now Beatty) of Albany, New York. Waitress. Doubtlessly part-time whore. Walter W. deceased (heart attack; stop snickering, dammit) January 2036; Frances L. still in residence in Tarrytown.

If this is all beginning to sound like a very complicated, very dirty, dirty joke, then here is the punchline—partial transcript of an interview with Sylvia Watkins/Beatty, presently living in Leeds, New York:

". . . he (Parmenter) drifted in around the twentieth of every month on his way back from Toronto, which I told him was the worst *possible time because damn it if he didn't always show up right during my period. Hell, I tell him, you want to get charged with a paternity suit or something? But he'd smile kind of funny and say, 'No, you don't have to worry about that,' and so we bed down with me thinking it's motherhood and bassinets for sure, but goddamned if nothing happened. Nothing* ever *happened . . ."*

Verification of conclusion implicit in punchline: medical records on Walter Parmenter reveal severe bout with mumps at age seven. Classic after-effects.

Now you tell me, Bert, just how a red-blooded, sterile American male can father anything, *even as bland and common a Tauran as this Humphrey Parmenter appears to be. If you will attempt a bit of analysis here, you may rightly conclude that we have here either (a) a common bastard, (b) the Second Coming, or (c) something that's going to set a lot more upper-echeloned fur flying than either (a) or (b).*

One last note, Bert: notice the date given as Parmenter's birthdate. Examine it closely. May 21 (or 22) 2025. Think back to the flowering of your youth, Bert. 2024 was an election year. It was, in fact, the first year in which the AAP got any solid foothold in Congress. And seven months later, June 15, 2025, the first of the Astral Amendments to the Constitution was passed: almost one month after the alleged birthdate of Humphrey Delaney Parmenter. Coincidence?

I don't see how you missed this, Bert, him working under you and all. I've got to sent this up to Lovell, you know that. I still have a few agents out in the field gathering data for confirmation, and I hope to hell they don't find what we both know they will. Sorry you have to be the scapegoat, Bert; under any other circumstances it would be me, Parmenter being a Taurus, but you're his direct superior, and Lovell is not going to forget that.

Really sorry, Bert.

Good luck,
Dick

28 Oct 2068: Parmenter Humphrey D: A period of adjustment domestically and professionally. Allow for fluctuations from the norm at work and at home.

A grey fog of indecision. Was Gloria right? Was he taking from her her only dream? Or could his dream, somehow, be related to Gloria's? Somehow Humphrey doubted it; there was no way that he could see that the fulfillment of his desires for a richer life could possibly affect hers. Either Gloria's own promise of happiness was yet forthcoming, or he had stolen that promise from her, warped it, twisted it, corrupted it to meet his own materialistic demands. He prayed that the former was the case. By the gods of all stars he prayed, the gods he was aware were responsible for this fissure of anxiety in the firmament of his once-calm, once-orderly life.

Once-calm, once-orderly. Ever-happy?

Not even the comforting (once, in a dream) routine of feeding & filing could placate his kindling guilt. The motions became robotic, meaningless, and for the first time he saw that they *were* meaningless, empty, vacant of any measure of importance or contentment. Hollow motions, and when you touched them they rang. Seconds like minutes like hours. And he had asked, no *demanded* more of this vacuous work? Oh gods. Oh Gloria. He had crushed the dreams of the woman he loved with dreams that were made of straw. Gods, gods . . .

Noon, its entrance always stealthy, padded softly into Humphrey's consciousness. Sagittarius Section, still and quiet and very suddenly nothing more than an air pocket in a block of plastic in which he spent his days in thrall to a machine he could not even see. And outside the building, there too he was slave to the machine: Ambition. Caution. Joy. Despair. Words impressed on a shiny white card of glistening plastic, words to be obeyed but never experienced. Words the meaning of which were only dimly comprehended by the semi-sentient beast fifty? sixty? storeys below. Empty words.

Irrationally, Humphrey weighed wife against job, home against work, love against routine.

Gloria's dream had been the right one all along. He saw that now. It had been the one to share, to reach for, to strive for. Could any promotion mean more than the fact that someone loved, needed you? Damn the stars—what did gods know of love?

Humphrey pushed himself away from the desk cluttered with paper lives cut from paper dreams by paper men. From the feeding, the filing, the fucking: had it been a hideous substitute for love all along, this routine? Had he enjoyed some strange coitus with the cool bright metal of the terminal? It no longer mattered; that was all behind him now.

Determinedly he approached the office of the supervisor. Not for the first time, but for the last; and by *his* decision, not the sky's. Shit with the job. Shit with the stars. Gloria mattered. Gloria would have her dream. *They* would have their dream.

A tap, not meek, not shy, on the door, the door half-opened, the door swinging wide, the door to Winslow's office. The office, as empty and hollow and vacant as the rest of this plastic world. Winslow too was gone. Winslow, who had been as much a slave to the stars as any of them.

27 Oct 2068: Parmenter Frances L: Visitors may be expected and welcomed. Cooperation today is essential to your continued well-being. Be honest in all dealings.

Q.: *This shouldn't take long, Mrs. Parmenter. Purely routine, you understand.*

A.: Of course, Mr. Langford. My stars, my Humphrey a senior file clerk for StarComp! My stars.

Q.: *Yes, they are. Now, when did you say Humphrey was born, Mrs. Parmenter?*

A.: Um, let me see. The twenty-first of May—2025, I believe. Yes, that's it. May 21, 2025. And now he's forty-three, and on his way to being an *executive.* It's hard to . . .

Q.: *Were you aware, Mrs. Parmenter, that his birth certificate* (ruffling in jacket pocket, produces photocopy) *gives that date as the twenty*-second *of May?*

A.: (taking the copy and looking it over carefully) *Why, yes, so it does. Well, it must be some sort of a mistake. It was the twenty-first, I'm certain of that.*

Q.: *Well, you should know. The physician who signed this certificate—*

A.: Doctor Robertson, poor man.

Q.: *Yes, he's dead now?*

A.: Over fifteen years. A very good man. Our family doctor since I was ten years old, would you believe that?

Q.: *I see. And consequently he felt, well, responsible for you?*

**The room became alien, foreign, malignant, once more.
The hum remained, hated for its clever seduction,
despised as a remnant of his former life.**

A.: Yes, I suppose he did. He had such a great love for all his patients. He founded the local orphanage back in '09, ran it for sixteen years, until–

Q.: *Until the first Amendment, yes. Was he very upset about that?*

A.: (thoughtfully) Upset? Why yes, I suppose he was. When they said his children, the ones whose birth dates were unknown or uncertain, would have to be . . . put away. He was very sensitive, that man.

Q.: *And thoughtful?*

A.: Yes. Thoughtful, too.

Q.: *And influential?*

A.: (puzzled) Influential, Mr. Langford?

Q.: *Certainly. I mean, a man like that, dedicated as he was, was in a position to help those in need. Especially friends in need. Old friends. Old patients. Administratively, that is to say.*

A.: (warily) I don't follow you, Mr. Langford.

Q.: *Well, a man like that might be able to cover up quite a bit, if he wanted to. Little things. Things like births. And deaths. And adoptions.*

A.: (chill silence; then–) Will there be anything else, Mr. Langford?

Q.: *Yes, Mrs. Parmenter, one thing more. Did Dr. Robertson have a faulty memory by any chance?*

A.: (a long pause) (tiredly) Yes, Mr. Langford, he did. Very faulty indeed.

28 Oct 2068: Parmenter Humphrey D:

The room was as dead as the rest of Sagittarius Section, as dead as Humphrey's faith in the unblinking stars.

Winslow was gone. Not at lunch, or out; gone. Charts, streaked with day-old pencil marks, flapped disinterestedly off alien walls. A wastepaper basket stuffed with wads of oily brown shopping paper marked the passage of too many lunches spent alone and cramped by work and pressure and the stars. That was all. Nothing further to suggest that any human being had ever inhabited this greyly dead office, or that any ever would in the future. Stark and silent and hollow.

Humphrey closed the door gently. He didn't know why.

Deserted, Sagittarius Section stretched before him. A thread of indecision tugged at his newfound determination; should he remain here, here in this vacuum, to await the return of some symbol of authority to whom he could give his resignation? Or–better–leave now, this minute, never looking back and the hell with decorum and thirty days' notice? In either case he would have a sticky time of it explaining his flouting of the will of the stars; but he might be able to sidestep the legalities, claim he was acting in accordance with the stars' advice to climb that damned ladder. Why not? Surely there were better jobs open to him than this robotic misery?

He debated the two courses of action silently, seated behind a desk not his own for he had promised himself he would never return to *that,* allowing each projected action to slip neatly into place, to be weighed and counted against other actions, other plans. The room, humming softly about him, lulled him into a Taurean routine of think & plan, plan & think.

Realizing this, realizing that the room was taking hold of him once more, he shook himself back to starless reality; the room became alien, foreign, malignant once more. The hum remained, hated for its clever seduction, despised as a remnant of a former life.

The hum . . .

Humphrey became aware of the soft purr as something more than mere vampish background: it was alien even to the extreme alienism of the room. The typers, which did not make that sort of sound anyway, were deathly silent, their operators far below Humphrey's feet temporarily inactive. The sour groan of a clock did not match that gentle hum. Not typewriters, not terminals, not the muted calls of traffic that filtered up through the hard white plastic. None of these, yet more penetrating than them all.

And getting louder.

28 Oct 2068: Lovell Davison B: Sudden developments may force your hand to move against your conscience. Can a man cut off his own hand?

A ribbon of white speckled by days no more than motes of dust: six inches, a man's eternity; ribbon's end, his death. Strips of life papered the walls of the office, obscuring the white plastic beneath; the Mayor, the city council, the police commissioner, the district attor-

He raised himself wearily from the chair, stood by that arcane symbol of status, the window, and looked out at the street fifty stories below.

ney, the heads of industry and the leaders of labor. Some short, some long, all vital. Importance undetermined by length.

And now Humphrey Delaney Parmenter, aged 43 years, five months, ten days and an odd number of hours—four inches.

Davison Lovell, Director of Astral Affairs, StarComp Manhattan, watched as the life of a common Taurus flashed before him for what must have been the fourth time that day, framed in the screen of a reference terminal growing from his desk like some great mutant barnacle. It was not particularly engrossing reading; Taurans rarely were. Raised with the knowledge of their own fastidious, inherently bland natures, they dutifully emulated those qualities; the result was an uncommonly common biography.

Lovell sighed, snapped a toggle and did not watch as the screen fell blank once more. Visualized ennui it might have been, but it was also a man's *life,* as important to him as was Lovell's own to himself. Periodically he was forced to remind himself of such things; creeping solipsism was an intrinsic danger in this line of work.

Lovell pushed himself away from his desk tiredly, swiveled in his seat to face the window-framed city before him. How many Humphrey Delaney Parmenters were out there in that steel cage of humanity? And by what names did they go? Aries, Taurus, Gemini, Leo, Cancer, Aquarius, Pisces—and what were they really? No one would ever know if they were careful. Parmenters, all of them; orphans, men and women quite obviously born, yet with nothing save their own existence to document that fact. How many alleged Libras were in actuality Virgos? How many Leos went by the name of Capricorn? How many?

In most cases it did not matter—if the government could not detect their orphaned status, it was doubtful that anyone else could or would. No harm would be done to the complicated framework of government so carefully erected in the last fifty years. The stars would be in no danger.

But there would always be accidents. Freakish twists of fate that opened a man's entire life before inquisitive eyes, eyes that strained and strained but could find no beginning to his lifeline—only an end.

Lovell sincerely wished that they had never uncovered Parmenter's adopted status. If the government had not, chances were that others—dissidents, rebels, "Astronomers," revolutionary elements that festered even in the most stable of societies—never would, either. But somewhere out there, tucked neatly away either by design or accident, was a birth certificate that could very well be the first chip in the walls of StarComp's plastic empire. A forged certificate that pointed out the fact that a man could live a Tauran life without actually *being* a Tauran, without having those supposedly-inherent non-Tauran qualities come to the surface and burst.

Under ordinary circumstances, Lovell might perhaps have taken a chance and done nothing, might have put his faith in the stars, the powerless nature of which he had known for forty years. But these were sticky times for the American Astrological Party; a splinter group had detached itself from the AAP and was running a candidate in the upcoming Presidential election in earnest, not simply the token one used for decades past. There was little chance of his winning, of course, even with a revelation such as this, but people might begin to think, might begin to weave Congress with threads of radicalism. A two-thirds majority could even revoke the Astral Amendments, and then it would be back to the *old* sources of government income, to the military-industrial complex and all that that implied, planes and tanks and bombs and puppet wars and everything that the AAP had promised a tired, war-weary, straw-grasping America that they would abolish. And *had.*

Back to all that.

Election Day was ten days away.

Credence could not be lent any story circulated about Humphrey Parmenter in these delicate days. Humphrey Parmenter could not be held up as a walking, talking, breathing example of the shallowness of astrology. Humphrey Parmenter was a weak link in a gold-plated chain forged fifty years ago for the benefit of the people, and what matter was it that below the golden surface was rusted tin?

Lovell raised himself wearily from the wide, leather chair, stood by that arcane symbol of status, the window, and looked out at the street fifty storeys below the domed crown of the StarComp building.

There came a muffled sound from many storeys below, like the final tremor of a dying man.

28 Oct 2068: Parmenter Gloria L: Unexpected news may at first shock, but acclimation may show it to hold some advantage.

Mrs. Parmenter?"

The man stood framed in the doorway, tall and thin and saturnine in feature, his creased face strong and leathery. He was not, Gloria decided, unattractive.

She smiled pleasantly "Yes?"

"It's about your husband, Mrs. Parmenter."

Her smile froze. She had tried not to think about him, the bastard, tried not to dwell upon the broken dreams and wasted schemes that had gone splintering out of her life long days ago. And now she tried to keep the coldness, the hatred from her voice as she said, "Humphrey? What about him?"

The man hesitated a split second. "I'm afraid he's dead, ma'am."

Just when she thought the last shard of emotion had hit her, another impaled her on the spot. She felt weak. She *was* weak. She stumbled off to find the couch, instead found the tall thin stranger helping her to a chair. She slumped dazedly into it. More shock than grief, it hit her; Humphrey, that obnoxious little dream-shatterer, that unresponsive, uncooperative little turd—dead? How?

She must have asked that aloud, for the man—a StarComp operative, she supposed—was explaining. "A dissident action," she heard him say. "They planted a bomb in Sagittarius Section, the stars know how, maybe set to do just a little damage because it went off during lunch break. But your husband didn't go to lunch. He must have been working, finishing up the morning's forecasts, and . . ." He let the sentence trail off.

A fluid calm enveloped Gloria. A moist silence came over the room. At length she nodded slowly.

"Yes, that would be very much like Humphrey," she said quietly. "Always working. He was very happy in his work. Yes." she agreed solemnly, "that's very much like Humphrey."

"Yes, ma'am. I'm sorry."

Gloria managed a brief, flickering smile. "Don't be. I'm afraid . . . we were never very well suited. I'll never understand why. But . . ." She took a shallow breath. ". . . that's all behind me now. Poor Humphrey." she looked speculatively at the tall, sympathetic agent who squatted by her side. He in turn looked very concerned over her continued happiness and well-being. As a matter of fact, so was Gloria.

"What's your sign?" she asked.

○

fiction/ Walt Liebscher

[illegible]

A Special Kind of a Flower

Love has been called the salvation of mankind—and children love best!

For all of his six years on this Earth, Lonny Dempster had lived a normal, happy life. Now it was the time of changes and his life would nevermore be the same.

A week before he was to enter the first grade of the township school his mother took him on her lap, nestled his curly head against her bosom, and gently rocked back and forth.

"How's Mommy's little boy today?"

"Fine, Mom, just fine."

"Can you keep a big, big secret?" She kept on rocking.

"If it's for you, Mom, I can."

She marvelled at the sound of his voice, like a highly honed alto flute, mellow and pure.

"Mom's going to tell you a lot of things that, at first, you will have trouble understanding. But, as time goes on, you will accept these things, and learn to cope with them. Now listen real hard. OK?"

"OK, Mom."

Then she told him of how a huge silver ship, from a far away star, had landed on Earth. Of how the people on this ship were different from Earthmen, gifted with powers of the mind far beyond anything he had ever experienced. They could rise off the ground, instantly remember any printed page, move objects just by thinking, and of a few very special chosen ones who could mentally draw in matter from the air, sea, and land, and produce objects, seemingly out of thin air.

She then explained to him why it was necessary to hide all of these gifts, of how the people on Earth were intolerant of differentness, and finally that she, his Mom, and his Daddy had been on that ship, and that he, Lonny Dempster, would have these gifts. She concluded with the repeated warning that no one, except for those on a list she would give him, was ever to know about these powers, nor were they to be used in public. Then, for a while, she was silent, and a bit frightened, rocking back and forth, back and forth.

She took his little hands and pressed them hard against her temples. "Now, my sweet one," she said, "I want you to clear your mind and don't think of anything."

He did as she asked and almost immediately felt the flow of it, the warmth of it, the sheer wonder of it. He had the gifts.

The next few weeks were pure joy for Lonny. In the privacy of his room he would rise up and fly around, he practiced moving his toys at will, he made music on his toy piano from across the room.

School was easy, as his mother said it would be, and he was becoming used to hiding his talents. And he liked the other kids his mother said he could play with, the ones like himself, especially a little girl named Suzie Colvin.

Then, slowly, but surely, he felt it all began to slip away. He still knew what people were thinking, but no longer could he elevate, or play his piano, or move things. The sadness began.

School became a nightmare. He had to study pages over and over again. He just couldn't remember. The other boys and girls like himself began to avoid his company, and he felt terribly alone.

One day Suzie found him sitting on a bench in the far corner of the playground.

"What's the matter, Lonny?" she asked. "You look real sad."

He looked at her, reaching out. "I'm scared, Suzie, I'm scared. I think I've lost the gifts."

"Are you sure? All of them?"

"All except the mind thing. I can still tell what the other ones are thinking. But I can't raise up, or move my toys, or any of those things."

"Gosh, that's awful," Suzie said. "But you can still block. I can't read you."

"I guess that's something," he said dejectedly.

"Maybe if you opened up for me it would help. Want to try?"

"You won't like it."

"But I'm your best friend, and I'm not afraid. Maybe I can help. Anyway let's try."

He took hold of her hand, pressed hard, and looked straight into her eyes. Then he released the block and let her slip in.

Almost immediately she recoiled in horror. Then she caught hold of herself and gazed into his eyes. Tear after tear after tear rolled down her cheeks as she was immersed in silent torment and stifling loneliness. But there was something, something strange and illusive that was almost blotted out by the ocean of tears inside him.

After a while, she withdrew and sat silent and sad.

"I told you you wouldn't like it," he said.

"Oh, Lonny, my poor Lonny, how dreadful. It's bad and I don't know how to help. Have you told your Mom?"

"I'm afraid."

"Afraid of your Mom?"

"Oh, not that way. I know she loves me, but I think I'm some kind of a freak, like in the circus, and I don't want her to know."

"Oh, Lonny, how terrible. But she's the only one who can help, I think. You've just got to tell her."

"I guess you're right. Thanks, Suzie." He got up and ambled slowly into the woods next to the playground.

She started to say something, but couldn't think of anything. And she wondered about that strange, puzzling, unknown power she had sensed in the back of his mind. Somehow she had to find out what it was. She was sure it was important, very important.

His mother knew something was troubling him. She also knew he would seek her out when the time came. He was an unusual one, her son, a loner, and she sensed he would never be really content, or at peace. But she must be careful not to let him know she knew, and not be overly protective.

"Can we talk, Mom?"

"Sure, son, something bothering you?"

"I suppose. Let's go out and sit in the swing. OK?"

"If that's what you want, sweets." She followed him out to the arbor.

"Mom, will you always love me, no matter what?"

He's hurting and he's very vulnerable, she thought. Be very careful. "Always, son, no matter what, and don't you ever doubt it." She gave him a big bear hug. "You're Mom's little treasure and you always will be."

For a long moment he basked in the warmth of her embrace. "Mom, I don't want you to hate me, but I can't help it."

That hurt and she fought back a welling of tears. Take hold. "Oh, son, no matter what it is that's bothering you, no matter what, I could never even begin to hate you. How could you even think of such a thing?" One tear did manage to slip through.

"Because I'm different."

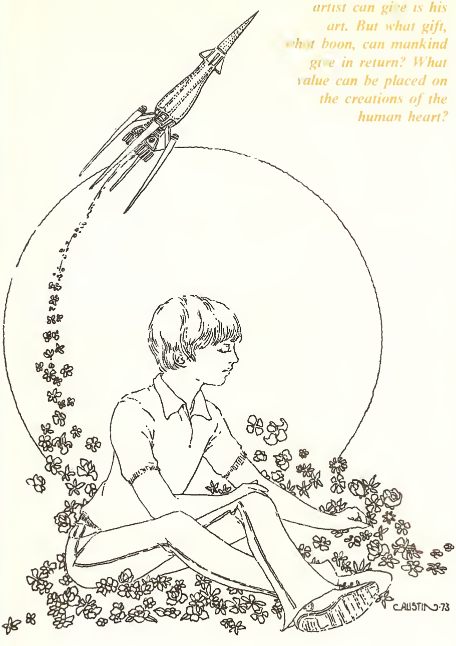
"Different? How?" She squeezed his hand to reassure him.

He drew in a deep breath and gave a long sigh. "I'm a freak. I've lost the gifts."

She was stunned. Great God, not that, she thought. He's a blind one. He really is a freak. What can I tell him?

Too late she realized that, in her confusion, she had unblocked. He knew. She looked down at his pitiful, searching countenance. The tears were flowing freely. There was nothing she could do. Nothing.

The greatest gift an artist can give is his art. But what gift, what boon, can mankind give in return? What value can be placed on the creations of the human heart?



"I'm sorry, Mom, really sorry." He slipped his hands from hers and walked away.

She made no attempt to stop him. He had to work it out for himself. Then she broke down and wept uncontrollably.

"Lonny is a lunkhead, Lonny is a lunkhead, can't move a stone or rise above his bedstead."

They had him in the center of a circle, and, with joined hands, were skipping around him. He just stood there, half hearing, deep in hurt. He couldn't fight back. He had nothing to fight with. He was incapable of hate. In a strange way, he felt sorry for his tormentors.

"Stop it, you mean kids, stop it," said Suzie Colvin. "Leave him alone."

Oh, go 'way, Suzie, and leave us alone."

"I won't. Besides he's better than you are. He's special."

"Ha," said one of the boys, "I'd like to see him prove it."

She walked towards Lonny and they broke the circle for her. She took his hands in hers and stared deep into his eyes.

"Lonny," she said, "listen to me. You are special. I figured it out. Think, Lonny, think real hard. Hold out your hand and think. Think—think flowers."

He held out his hand. "Think flowers, Lonny, think and make a rose."

He began to feel the flow, the power. He concentrated deeply. Suddenly, from nowhere, a deep, red rosebud appeared in his hand. For the first time in months, he smiled. The others stared at him in stunned silence.

"See, Lonny, you can do it. You are better than they are." She threw her arms around him and gave him a big hug. "Make another, Lonny, you can do it. You're one of the special ones."

Again he held out his hand and concentrated. He produced a flower so big, so ravishing in its beauty, the others gasped with sheer astonishment. Then he slowly turned, looking at each one in turn, and walked out of the circle. "Thank you, Suzie. Thank you so very, very much."

She stood there, the huge flower resting against her tear laden cheek. Behind him, as he walked, he was leaving a trail of flower petals.

The next morning, the townspeople were astounded to find every surface street in the township inundated with flower blossoms. They found him at the end of Main Street, lying on the only bare spot. Death had frozen his face into a radiant smile.

Everyone for miles around attended the funeral. Some of the parents were reluctant, but all of the children had insisted on being there.

When the services were over, and everyone had left, a lonely little girl walked slowly up to the grave.

"They will never understand, Lonny," said Suzie Colvin. "It would have been very bad, having the special gift and none of the others. But I've got them all, Lonny, I really have, thanks to you, and I will miss you so very much."

Then she held out her little hands and thousands of lustrous petals dripped from her fingers, mingling with the flowers on the grave.

Several days later, when the caretaker came to clean up the grave, he was amazed at the color and size of a still fresh looking rosebud in the center of the other drying flowers. He reached down to touch it to see if it was real. It was.

Then he shrugged his shoulders, shoveled everything into a wheelbarrow and pushed it towards the incinerator.

Had he taken the time to examine the bright, metallic looking petals scattered throughout the flowers, he would have found them to be pure gold.

GERALD FITZGERALD AND THE TIME MACHINE

from page 33

up on the ancient Grecian gods. I've got a theory about that lightning bolt Zeus had being a raygun."

"I'm afraid the machine doesn't have much range, Bill," he said.

"Okay, okay, so we make records of Lincoln at Gettysburg or do a little combat photography at Bull Run or New Orleans or Breed's Hill. Gee, and there's Concord bridge and Fort Sumpter and Ford's Theater. My god, man; why haven't you gotten started? How much money do you have? Maybe we can get enough together for a movie camera and lots of film and a tape recorder. I'm a little short right now, but once we get it going–"

"Look, Bill, there's just one . . ."

"Of course, we'll have to get a battery pack and maybe some portable lights. Oh, and a costumer for authentic clothes. Wow, there are a million things to do! Look, sit down at the typewriter there and start making a list, we don't want to get caught short someplace . . . or should I say some *when?*"

"Now wait a minute, this thing–!"

"We'll need a couple of guns, just in case. Automatics would be good. And ammo. Then there's the recorder, costumes, film . . . oh, and lots of tape. Will you need extra batteries or whatever you use in your machine? I don't want to run out and become my own grandfather or anything. Especially since I know what my grandmother looked like. Now on my mother's side, she wasn't bad . . ."

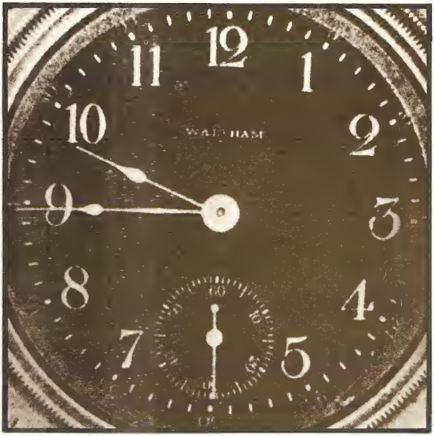
"Hey!"

"Look, how's this? You get on the Confederate side and I'll get on the Union side and we'll shoot the War of the Rebellion from both angles. Same with the Revolution. And look–we could rig a camera on the side of the ship and get those torpedos of Farragut's. They were really mines he was talking about, you know."

I shook my head. "Man, think of the deals! The networks will flip! Underwater shots of the Maine blowing up, the Titanic going down! Aaron Burr and Franklin's kite! And all those famous people . . . Pavlova and the birth of Groucho Marx! Washington crossing the Delaware. Think of the signing of the Declaration of Independence in Technicolor! And if you've got the stomach for it, we might get the heads dropping into the basket from the guillotine and the storming of the Bastille!"

"Bill. Bill. Hey, Bill!"

"Are you getting this all down? We'll need money, too. That'll be a problem unless we can get some gold bullion. Gold has always been good. A good book on history, too. That one by Beard isn't bad and it's small. Oh, and an almanac, like Mark Twain had in that story. Yes, put that down and . . . what is it? Stop waving your arms."



"It wouldn't be a time machine if it didn't move in time. But, well, it has distortion, like I said. And a short range. And it isn't calibrated. Besides, I lost the manual."

"It really isn't very powerful," he said. "It doesn't have much range."

"Yes, yes, you told me. Well, stop bouncing around in your chair. What is it now?"

"Well . . . it has practically no range at all. In fact, it is hardly a time machine at all." He looked somewhat shamefaced up at me.

"What-the-hell you been giving me, boy?" I snapped. *"Have you or haven't you a time machine?"*

"Well, yes. I've got one. Don't you worry, I've got one!"

"Look," I said, "I'm giving you a break taking this over. You never realized what a sweet deal you had here. But remember, we're *not* going to bump off anyone's grandparents. We're not going to try and change history, either–that can get just too damn confusing. I've read too many time travel stories where they got all fouled up."

"Dammit, Bill, it moves in time only a teeny bit. And sometimes not at all.

In fact, I don't ever remember it working decently. Distortion and stuff, y'know."

I looked at him for a long moment. "Have you tested it?" I asked.

"I lost the manual," he said.

"Hell, don't worry," I said with a reassuring smile. "We can experiment. Send a few cats back and forth, that's the classic way."

"Uh . . . we might get in trouble with the FCC or something."

"Where did you get it?" I asked patiently.

"I made it."

"Oh," I said.

He frowned at me. "What do you mean, *Oh?*"

"Just plain oh."

"You mean you lack faith in my Yankee ingenuity? Is that it?"

"I wouldn't say that. Seen anything good on TV lately?"

"How could I see anything good when they aren't making anything good? But you haven't any faith in my Yankee ingenuity, have you?"

"Well," I said, "I . . ."

"Yankee ingenuity. The same thing that old Cyrus Blochtaw had in 1819 when he invented the automobile to eliminate the horsefly. And the same thing that Samuel B. Ferris had when he made the first Ferris wheel in 1801. Yankee ingenuity—the very thing that created the first practical diaphraghm and the strapless bra, the very thing that invented the pill and the no-bra look. And what about the boomerang?"

"What about it?" I asked.

"We'll get back to that. But it was all good old Yankee ingenuity, the same stuff you have no faith in."

"Well," I said, "I didn't want to see your time machine anyway."

"And why not? Don't I always look at your stupid photographs, even though I'm a leg man and you're a breast man? By god, Rotsler, you'll look at my time machine or I'll tell everyone you wear a beard because you're trying to prove something!"

"You've won me over, Fitz. I will look at your time machine."

"It's in my room."

"This is your room."

"Well, it's in here, then."

"Where?"

"Right there."

"But that's just an old Atwater Kent radio."

"That's the beauty of it. It just looks like an old Atwater Kent. I designed it that way. Pulls its power from the air, a good precaution in Shakespeare's England where there's a scarcity if not a complete lack of power plugs."

I looked at the Gothic shape of the time machine. "I have a feeling it doesn't work," I said.

"Who the hell said it didn't work?" Fitzgerald snarled.

"Good!" I said happily. "I'll rush right out and see how many of these supplies I can get on credit. I'll use your name."

"Whoops! Don't rush away. You ought to know something. This machine is a pilot model."

"What does that mean?" I asked suspiciously. "That it doesn't work, or may some day real soon now?"

"Sure, sure, it works, it works," he said confidently. I felt better. "It wouldn't be a time machine if it didn't move in time. But, well, it has distortion, like I said. And a short range. And it isn't calibrated. Besides, I lost the manual."

"Well, who wrote the manual?"

"I did."

"Then it doesn't matter if you lost it. Rewrite it as you go. Here, is this the switch?"

"Now you've done it!" he shouted. "You've turned it on! Mortal eyes were never meant to see this!" Fitzgerald rose swiftly and crossed the room like a giant jungle cat, and smashed the time machine with a chair. Then he sat down again. "That was quite an experience, wasn't it?" he asked.

"What was?" I asked.

"Why, moving into 1990 or 2000 the way we did."

"Who did?"

"We did. It was 1990 or maybe 2000, right here in this room. Didn't you hear the atomic bombs going off in the distance?"

"Uh . . ."

"Sure, you did, and that's why time machines are so good. Suppose your Aunt Grace had a time machine and she heard the H-bombs going off in 2001 or whenever. Can't you see the danger in that? Why, she'd have you out—"

"Digging a fallout shelter!" I cried. "Hundreds of cubic feet of dirt, blisters on my creative hands, sweat making me itch, mindrot in my fine mind—Fitz, you've done me a great favor, destroying that sinister device! It was an act of supreme friendship!"

"I think so, too," said Gerald Fitzgerald. ○

"His old man cut him off without a scent!"

CYNTHIA

from page 44

the years. Finally she smiled and gave up. "Too long to remember."

"Fifty years."

"You're a relative of his?"

"This is very difficult, Cynthia."

"Difficult?" She ignored the use of her first name.

"This," said McCann, indicating Garraty's body by opening out his arms as if displaying a new suit, "is the result of a transfer."

"Ahh," said Mrs. Stewart, following it immediately with a longer "Ahhh," as fuller understanding came to her.

"Who is he, gran'ma?"

"I think he's someone I knew a long time ago, dear." She looked up at McCann. "Is that right?"

"Yes."

She inspected McCann as if she, too, were appreciating his new suit. The process annoyed Garraty. "It even looks a little like you."

"I know."

—*What's all this* it *business?*

Momentarily, the conversation died.

—What do you say after fifty years, Garraty?

—*You got me.*

Mrs. Stewart shifted slightly in her chair, repositioning the child. Garraty could hear the rustle of her ankle-length skirt against the chair.

"It sounds a little foolish, Ted, but how have you been?"

McCann laughed. "Good, Cynthia. Better now."

"Did you find it?"

"What?"

"Success, adventure—whatever it was that made you leave."

Garraty detected a muted note of bitterness in her voice.

"Most of it."

"Not all of it?"

"Everything but you."

Mrs. Stewart averted her eyes. After a few moments, she lifted the girl to the floor. "Julie, go in the other room and play."

"I don't want to, gran'ma."

"Please go, dear,"

The child sulked to the door, glancing back at McCann with a hostile expression. When the door closed, Mrs. Stewart returned her attention to McCann. Watching Cynthia Stewart, Garraty understood some of McCann's feeling for her. Even at her age, traces of beauty remained, settling to a gentle grace and dignity.

—*She must have been beautiful.*

—She was.

"Tell me about the years, Ted."

Haltingly at first, McCann told her of his youth. McCann, a marine biologist, had worked for the government, a safe life, secure and sheltered. He wanted nothing more than to make some small contribution to human understanding. When he met Cynthia, life changed. Earth looked staid and conservative, offering him none of the opportunities he needed. He wanted to give Cynthia everything. He decided to leave Earth, hoping to find rewards adequate to his ambition. His plan—to succeed quickly and return for her—seemed always just out of reach. He wandered from planet to planet, hope and rumors of opportunity pulling him on. Earth-type planets reproduced Earth's society. A man neither starved nor grew rich.

Only uninhabitable worlds offered risks and rewards. A small company, formed to exploit a planet called Geros, hired him. His marine biology background fit perfectly with the planet, a landless expanse of hostile ocean, rich in mineral wealth and danger. Methane choked its atmosphere and predatory lifeforms filled its ocean.

They planned to establish a mining colony on the ocean floor, subsisting on local flora and fauna. After extracting sufficient wealth, they would leave. The plan ran head-long into U.N. policy. Human beings must adapt to alien worlds.

They had two choices, an outlaw mining venture or adaptation. Abandoning the venture was out of the question. Too much had been invested. Since the U.N. knew of their plans, only adaptation proved feasible. McCann underwent a series of operations.

"What kind of operations?"

"Structural and metabolic alterations."

Cynthia Stewart hesitated, unsure whether to ask her next question. "The operations changed you."

"Yes."

"If I may ask, how did you look?"

"The changes were substantial."

McCann worked up in the company, owning a controlling interest by thirty.

"I consulted doctors about readaptation. The process was irreversable. I was already too old to withstand the trauma. I realized I'd lost. I had everything I wanted, everything except you."

"You never tried to communicate with me."

"At first, I wanted to come back rich, to offer you everything all at once. I know it was foolish, but romance, youth, enthusiasm—something in me wanted it that way. Later, after I knew I wasn't coming back, I couldn't bring myself to communicate with you."

"I loved you."

"I know that."

"Why did you leave?"

"For you."

"For me? No. For something else. For adventure. Damn your adventure, Ted." She fell silent, wiping the tears from her eyes with a white handkerchief. The emotion had flushed her cheeks, giving an illusion of youth.

McCann pulled the tickets from his coat pocket, placing them on the coffee table in front of him.

"Cynthia."

"What?" She put the handkerchief away and sat up, inhaling deeply to calm herself.

"I can give you everything now."

She laughed, a short painful laugh that almost started her crying again. "It's too late. We're—I'm too old."

McCann showed her the tickets. "When we get to Hector, I've made arrangements for a transfer. Both of us will be young. We'll have a second chance. Cynthia, please look at me."

"It's too late, Ted."

"Why?"

"It just is. People change. I'm old."

"You don't have to be."

She looked at McCann, an unexpected hardness in her face. "Is someone else's body going to make me young again, Ted? I waited. I waited *then,* when we *were* young, and one day I knew you were never coming back. I had feelings for you. I probably loved you. But that was a long time ago." She faltered, beginning to cry again. She stood up, daubing at her cheeks with the corner of her handkerchief. "You've upset me, Ted. You see how easily old women get upset."

She started toward the door, her gait the precarious side to side movement of an old woman.

"Cynthia."

"Please. I'll be back in a moment."

—*So that's it,* said Garraty when she was gone.

McCann remained silent. Garraty could sense the intensity of McCann's feelings, compounded by Garraty's own presence.

—*You'll never get away with it.*

—We'll see.

—*They'll track you down, McCann.*

—It's been taken care of.

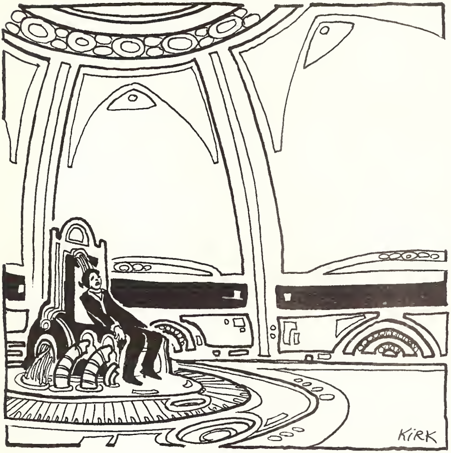
—*How?*

—I'm a wealthy man.

—*How are you going to take care of me, McCann?*

The hall door opened. Cynthia Stewart reappeared, her face dry but

Older men, discovering their conscious companion, seldom wanted company or advice, usually preferring to conduct their business and go home. Old men felt threatened.



puffy around the eyes. Somehow, she seemed older to Garraty. She walked erect, avoiding McCann's eyes.

"Ted."

"Yes."

"I'm afraid you'll have to go now."

"Go?"

"I have lunch to prepare and my daughter and son-in-law will be home soon. I have to—"

"Cynthia," said McCann, standing up. Garraty sensed McCann's confusion. Responding automatically, Garraty concentrated on his own integrity, establishing as much emotional distance between McCann and himself as possible. McCann's feelings, sharp, wounded, intense, worried Garraty. He could control empathy. Residual emotion, involving the entire organism, was determined by McCann.

—Calm down, McCann.

Abruptly, the hall door opened, admitting the child. She pulled up short, staring at McCann.

"Gran'ma, why is the man crying?"

"He's not, dear," said Mrs. Stewart, walking toward the girl and taking her hand.

"He is. I can see him, gran'ma."

She led the girl toward the door, telling her not to worry about the man. The man was leaving and mommy would be home soon. Grandmother and granddaughter left, hand in hand.

—McCann?

McCann was silent.

—Say something.

McCann walked into the hall, the door sliding open before them. He turned toward the stairs, gazing up. Somewhere in the house, Garraty could hear the faint sound of Cynthia Stewart talking to the girl. McCann looked at the floor, shaking Garraty's head from side to side.

"I would have given her everything."

McCann turned toward the door.

Outside, the sea breeze had picked up. It harried a half dozen maple leaves across their path. McCann walked slowly through the swirling leaves, lost in thought. Garraty wanted McCann to vent his feelings. He remembered the weeks of dis-equilibrium after the attorney transferred. McCann's feelings were stronger.

They boarded the monorail to Los Angeles, finding a seat easily in the sparse mid-day traffic. McCann gazed out the window, oblivious to the passing towns. Garraty felt McCann's sense of futility and loss. He fought the feelings, trying to imagine himself with rod in hand, playing out line, working a trout. The emotions receded.

In Long Beach, they changed to the subway. McCann was returning to the Transfer Building.

—McCann. Listen to me. You can't transfer now. There is something called transfer shock. Listen, please.

McCann stayed locked within himself.

—If you transfer in the state you're in, the shock could kill you.

—Does it matter, Garraty?

—Yes, it matters. McCann, listen.

McCann said nothing. Their car emerged from the tunnel, sliding into the 6th and Olive station. McCann, silent and withdrawn, exited, mounting the escalator. He rode a single step to the top. On the street, they started for the Transfer Building, a twenty-story circular building surrounded by a park.

They entered the building on the ground floor, admitted by Garraty's profile. The technician, a stocky man with firm hands, led McCann to the transfer room, helping him into the helmeted chair and beginning to set up the transfer. Throughout the procedure McCann stared straight ahead. The technician withdrew into the glass paneled control booth, signaling with a thumbs-up gesture to indicate the transfer was ready.

—McCann. Listen to me. Stop.

—I would have given her everything, Garraty.

Garraty saw the technician reach for the transfer stud. Garraty wrenched, suddenly embodied. Grief overwhelmed him. Tears streamed down his cheeks. His life seemed worthless, wasted. He wept, unable to control himself.

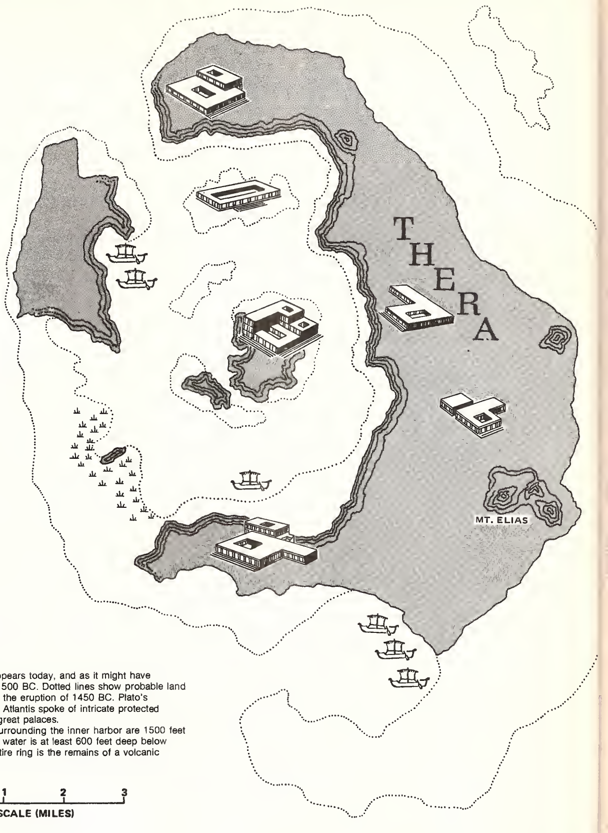
The technician's voice, tinny on the intercom, filtered through Garraty's despair. The man was saying something. It was difficult to concentrate.

"Mike?"

Why was he talking?

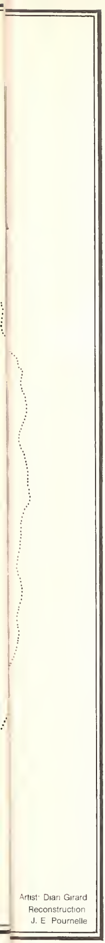
"The electrocardiograph on Geros just stopped."

How could it matter, now, without Cynthia. ○



Thera as it appears today, and as it might have appeared in 1500 BC. Dotted lines show probable land areas prior to the eruption of 1450 BC. Plato's oescription of Atlantis spoke of intricate protected harbors and great palaces.

The cliffs surrounding the inner harbor are 1500 feet high, and the water is at least 600 feet deep below them. The entire ring is the remains of a volcanic caldera.

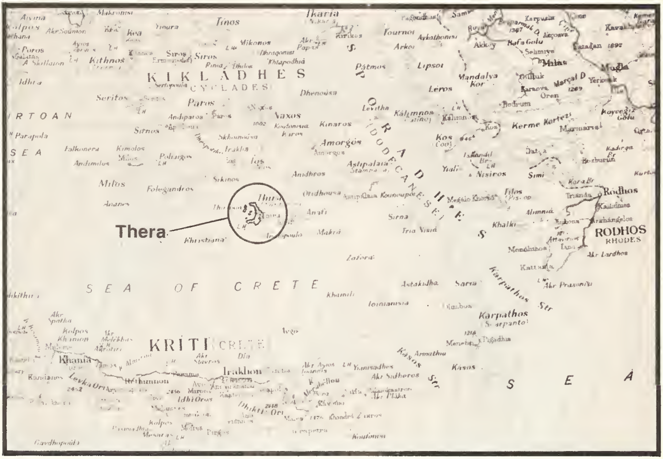

Artist: Dian Girard
Reconstruction
J. E. Pournelle

Ever since 550 BC, when Plato told the story of Lost Atlantis, men of imagination have searched for the vanished empire; and Atlantis is only one of the ancient legends which have fascinated us throughout western history. Now, it seems, many of the old legends may have been true stories, and the Atlantis legend, once thought the most fantastic of the lot, could be real history. Lost Atlantis has left the realm of metaphysics and become a subject of serious scientific debate—and if the Atlantis story is true, an even more incredible tale may be true as well. □ □ Plato's original story is the oldest surviving Atlantis reference. In two dialogues, the *Timaeaus* and the *Critias*, Plato tells of Egyptian records studied by his ancestor, Solon, a famous scholar, politician, and poet. The records, handed down to Plato through three generations and inevitably distorted, described a series of catastrophies so severe that the Greeks and other civilized peoples were knocked back to savagery, and "*the survivors died with no power to express themselves in writing.* □ □ The same records also assert that some heavenly body struck the earth and was remembered in the legend of Phaeton, son of Helios. Phaeton drove the chariot of the sun so close to earth that the world was scorched and nearly died in chaos and darkness—after which, according to other legends, there were floods. The Egyptian records stressed a number of catastrophes, not merely the one that destroyed Atlantis. □ □ The Atlantis legends are given in great detail. They told of a Bronze Age empire founded by Atlas, son of Poseidon—

ATLANTIS
Fact or Myth?

The legends of Atlantis
have built to the point where they
have become scientifically
ridiculous. But, stripped of
past the stories invented in the
2,500 years, and in the
light of new discoveries,
perhaps the Atlantean legends
of ancient Greece make sense.

article/**Jerry Pournelle**



"Atlantis" means "children of Atlas." It was an empire of many nearly independent kings who periodically gathered at the capital to sacrifice a bull to Poseidon. According to Plato's account, nine thousand years before his time the Atlantean Empire conquered extensive territories extending into North Africa, the Aegean, Greece, and southern Italy.

Eventually the sons of Atlas became corrupt and repugnant to the gods. There was war with Greece, and Atlantis lost to an Athenian army. Then, suddenly, there was a series of disasters. The Athenian army was swallowed by an earthquake. Atlantis, "in one terribly day and a night," sank forever beneath the sea, and travel to Atlantis became impossible because of the mud and shoals that rose around the island.

Even in Plato's time there were sceptics. Aristotle's only recorded comment on Atlantis was "he who invented it destroyed it." However, although Plato often told fantastic stories in his dialogues, he took care to insist that this one was true. Many people have believed in Atlantis ever since.

Interest in Atlantis may have been one reason for the Voyages of Exploration in the great Age of Discovery. Columbus was aware of the legend, and there is evidence that Atlantis was the real object of his search. After the exploration of the New World there was a lag in Atlantis' fortunes, but fascination with the Lost Empire reached a fever pitch with the Nineteenth Century publication of Ignatius Donnelly's *ATLANTIS, THE ANTE-DILUVIAN WORLD.* Donnelly, a former US Congressman and noted amateur scholar, wove together legends, traditions, archeology, and geology to produce a book so convincing that it is still in print.

At the same time, the discovery of Troy by Heinrich Schliemann discouraged the then prevalent sceptical philosophy of history. If the Trojan War almost certainly happened much the way Homer described it, why couldn't Atlantis have existed? "I have gazed upon the face of Agamemnon," Schliemann telegraphed to the King of Greece after one of his most spectacular finds; and although Schliemann was wrong in dating that tomb, it did not make the find less important. Truly a great civilization existed in the Bronze Age, and just as clearly many of the old legends had a foundation in fact.

Telephone cable ships charted the Mid-Atlantic Ridge, an underwater mountainous formation of which the Azores are the visible top. It seemed very reasonable to assume that a continent

Located near the center of the Sea of Crete, Thera would have been in an excellent location to influence legends on Rhodes, Crete and the Greek Islands.

had once been there and now lay a mile beneath the sea. Obviously Atlantis, enthusiasts cried.

Moreover, there were distinct similarities between New World cultures and those of ancient Europe. Some of the similarities were exaggerated, some pure fraud, and some careless error. The most famous of them all, supposed carvings of elephants in Yucatan, proved to be an enthusiast's mistake—the creatures are almost certainly stylized macaws rather than feathered elephants. Still, when the questionable evidence is discarded there remain solid facts. It is all too much for coincidence—either there was contact between Europe and America prior to the Age of Discovery, or Atlantis influenced them both.

By 1926 there were at least 1,700 books on Atlantis. Atlantean societies were formed in both Europe and the US, and rivalry among Atlanteans was so bitter that one French group broke up another's meetings with stink bombs.

Suddenly geology dealt Atlantean studies a nearly fatal blow. The best current geological theories now hold that the Mid-Atlantic Ridge, far from being the remains of a sunken continent, has been pushed *up* by continental drift, and is rising still. No geologist believes there was a continent, or even a large island, in the Atlantic in the last 40,000 years.

Anthropologists also showed that New World cultures couldn't have been nearly old enough to have been started by Atlantean refugees. The Mayans and Incas and Aztecs flourished only decades to a few centuries before Columbus. In desperation, Lewis Spence, one of Donnelly's more reasonable followers, postulated a second lost continent: Antillia, where the cultures were preserved until the proper moment, after which Antillia also sank to leave the present Antilles islands. Needless to say, there is no more geological evidence for Antillia than Atlantis; while explorer Thor Heyerdahl has demonstrated conclusively that European ships could have visited America from the Bronze Age on. In fact, the currents of the Atlantic are such that any extensive merchant trade outside Gibraltar practically guarantees that some ships will be blown across to America—where the crew might well elect to stay among the Indians rather than hazard the long journey back.

Spence and Donnelly, for all that they were true believers, were reasonable men. However, there were other Atlantean enthusiasts. Scientific evidence utterly vanished as "metaphysical seekers" took the field. They believed, as did Donnelly and Spence, that Atlantis was the mother of all culture and civilization; but they went much further. After World War II metaphysical Atlanteans even became convinced that Atlantis had known atomic energy and anti-gravity, despite Plato's detailed account of a Bronze Age civilization.

Edgar Cayce, the Virginia "sleeping prophet" who gave osteopathic diagnoses while in a trance, became convinced that many of the people he met were the reincarnations of Atlanteans, and believed himself to be the reincarnation of a priest named Ra-Ta. The Great Pyramid and Sphinx were, according to Cayce, built about 9000 years ago by Atlantean refugees. No Egyptologist could convince the metaphysicians differently; the serious search for Atlantis had ended.

This has all changed in the past few years. Many archeologists now believe that the real Atlantis has been found, and that Plato's story is a good summary of the rise and fall of a real empire.

The similarity between Atlantis as described by Plato and the Minoan culture that flourished on Crete until about 1400 BC (and was utterly unknown to Plato, so that he couldn't have been copying Crete for a made-up story) was noticed in the early part of this century, but the nature of "Atlantean research" kept academic scholars from becoming involved. Then, too, there were discrepancies in date, time, and place.

Plato's Atlantis supposedly flourished some 9,000 years before Plato, at a time when almost certainly there was no Bronze Age culture—and even less likelihood that any records of it could have reached Plato. Moreover, Plato's island is much too large, and he placed it in the Atlantic, not the Aegean near Crete.

However, Greek and American archeologists have made a series of finds on both Crete and the volcanic island of Thera nearby; and the evidence shows that the Minoan Empire was very powerful, probably dominating the Aegean and much of the Greek mainland; that it was conquered or otherwise dominated by Greeks for a short period before its end; and that it vanished suddenly, violently, and quite permanently in a volcanic cataclysm.

The coincidence between the archeological evidence and Plato's story was utterly convincing for Athens Professor A. G. Galanopolous. Greek scholars have always been more ready to take their legends seriously than anyone else; but Galanopolous has good evidence, if only he can account for the dates and sizes and locations. He has evolved an ingenious theory that fits the facts, although there may never be proof.

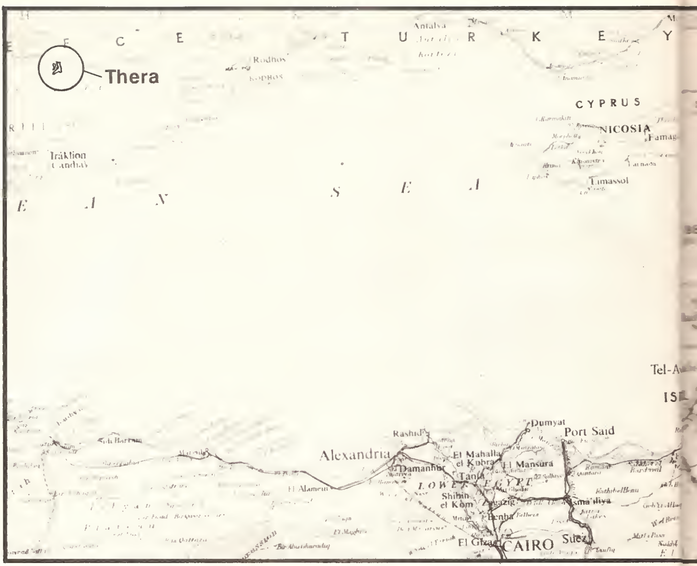
Galanopolous theorizes that Plato's ancestor misread the Egyptian documents, translating the symbol for "hundreds" as "thousands." If we grant this hypothesis, the island shrinks to the proper size. Plato's dimensions for the fertile plain of Atlantis become almost exactly those of the central plain of Crete. The physical descriptions of the island sound much like Crete. Since Plato knew the size of the Mediterranean, and had the wrong figures for the size of the island, he *had* to put it in the Atlantic: he knew there was no room for an island that size in the Mediterranean. More importantly, the Fall of Atlantis would then take place about 1450 BC.

That is a very interesting date. It is about the time that the Minoan Empire vanished, suddenly, in fire and smoke and volcanic ash. True, Crete didn't sink beneath the sea, but Thera did; and a mighty empire fell, cities were burned, and the highest civilization of the Mediterranean vanished forever.

That date—1450 BC—is also the time at which Immanual Velikovsky placed a catastrophe. Dr. Velikovsky, a psychiatrist and student of mythology, began his studies with the intention of demonstrating the literal truth of the Biblical account of the flight of the Children of Israel from Egypt. Before he was finished he was convinced that a series of catastrophes had taken place in historical times.

To account for these he postulated a new theory of cosmology that no astronomer can accept. Velikovsky believes that the planet Venus was once a part of Jupiter until it was ejected and narrowly missed Earth before coming to its present [stable?] orbit. There were other near collisions with other planets including Mars, and these account for many Biblical miracles, as well as other disasters told of in world-wide mythology.

To accept Velikovsky is to reject nearly everything known about celestial mechanics: there is simply no known way that Venus and Mars could narrowly miss Earth and now have orbits that do not intersect Earth's. If there were interactions with other bodies which forced Venus and Mars into their present orbits,



those bodies would now have orbits intersecting Earth's. Velikovsky argues persuasively for catastrophic disasters recorded in myths and legends, but his explanations seem fantastic.

However, those interested in Velikovsky's cosmology should consult his books. He is a far more eloquent spokesman than I can be, since I don't accept his theories. I do believe, however, that he has made a valuable compendium of the myths and legends of catastrophe—and these are very convincing in their unanimous and near-identical accounts.

It is difficult to discuss Velikovsky because he has been the victim of one of the most scurrilous and shameful episodes in the modern history of science. His books were ridiculed by reviewers who made a point of stressing that they had not and would not read them. A prominent astronomer, Harlow Shapley of Harvard, led a veritable vendetta against Velikovsky. So much pressure was put on the MacMillan Company that this publisher actually gave up Velikovsky's best-seller to the rival Doubleday, which has no textbook department and thus could not be hurt by the threatened academic boycott.

The Velikovsky affair has haunting reminders of the episodes between Galileo and Cardinal Bellarmaine; only this time the scientific community played Grand Inquisitor, and not nearly so fairly as Bellarmaine did with Galileo either. Velikovsky was definitely not given a fair hearing. Whether, after a hearing, his cosmology ought to be accepted is another matter.

We need not believe in "worlds of collision" to see value in Velikovsky's work. As professor C. Scott Littleton, anthropologist at Occidental College, points out, Velikovsky's mythology studies are impressive evidence for some kind of disaster around 1450 BC. Moreover, Littleton notes, the further Velikovsky strays from the Aegean area, the less convincing his evidence becomes; but in the Aegean area there are so many accounts of catastrophe that an examination of physical and archeological evidence seems clearly indicated. Just what could have happened to produce so many descriptions of stone gods rising from the sea; cities overshadowed by mountains; days of darkness at noon; the earth groaning in agony; even war among the gods?

The ancient island of Thera, once known as *Kalliste* (the Beautiful) and now called *Santorin*, is an impressive place. It takes only a glance to know this

Sorting fact from myth is, at best, a difficult task where ancient history is concerned, but there is a distinct possibility that the Biblical Philistines were the survivors of the destruction of Atlantis.

is the remains of an ancient volcano of immense size. Archeologists have known since the last century that a high Bronze Age culture flourished on Thera. During excavations of pumice—volcanic ejecta, bubbly floating rock of which more in a moment—workmen on Thera uncovered the remains of great walls, houses, palaces.

There were few serious excavations until recently, but now rich finds have been made on Thera by Professor Spyridon Marinatos, Director General of the Greek Ministry of Antiquities. There were Bronze Age palaces on Thera, some in no way inferior to the great Minoan palaces on Crete. Marinatos and his associates have recovered gaily colored frescoes and murals of exquisite artistry and detail. His workers painstakingly assemble tiny bits of fallen colored plaster like giant jigsaw puzzles. They have found: monkeys, children, flowers, dolphins, boats, and everywhere, as on Crete, bulls. There is no doubt that prior to 1450 BC Thera was an important part of the Minoan Empire.

Occupation of Thera ended abruptly. The people fled from the island, taking with them small portable riches but leaving behind tools, looms, and most large objects no matter how valuable. Sometime after that, Thera blew up with a force five to ten times that of Krakatoa. It has been estimated that the explosion was equivalent to a *2000 megaton bomb!*

Many scholars believe this was the Fall of Atlantis.

Radiocarbon dating makes it virtually certain that the explosion of Thera took place around 1450 BC. That date can be argued some fifty years either way, but there can be no doubt of the violence of the explosion. It was the most powerful known blast in human history.

The volcano would have been visible for hundreds of miles. As far away as Egypt it would have appeared as the Biblical "Pillar of fire by night and column of smoke by day." The resulting tsunamis would race across the Mediterranean toward Egypt, producing dry land where there had been sea—until, about 80 minutes later, the water rushed back to engulf anyone on the former sea bottom. The similarity to *Exodus* is obvious enough.

Volcanoes are very nearly the most powerful phenomena on earth. Only one other event could produce similar effects: the impact of a large meteor. We know that the earth has been hit by many of these in its history, some *very* large. Hudson's Bay is thought to be a meteoric crater. None have been known since men began keeping written records, though, and Thera was powerful enough to bring down Atlantis.

When Thera exploded it ejected cubic miles of pumice and ash. Volcanoes in modern times, with smaller eruptions, have produced days and hours of utter blackness. The smoke and ash blots out the sun. Lamps are lighted—and upset by earthquakes. Javanese villages were burned this way after Krakatoa, and it appears very likely that this was the fate of the Minoan Empire.

That Empire had either very recently been conquered by Greeks, or its remains were taken over by Greeks following the disaster. Prior to about 1500 BC the written records of Crete are in Linear A. This script has not been deciphered, but it appears to have been related to Hittite and was probably the language of the Minoan—I may as well say Atlantean—Empire. Then, suddenly, the script changes. Linear B predominates.

Linear B is nearly the same script as Linear A, but the language is Greek. The script is poorly adapted for writing Greek; writing even the simplest records in it is a lot of work. To victorious barbarians who had never known writing, it would still appear as magic. The conquered scribes used their script to keep records for their new masters.

There is no poetry in Linear B. Every tablet tells the same story—an Imperial bureaucracy, meticulously recording taxes paid, equipment issued, property owned, debts owed and paid. The Achean successors to King Minos used the gift of writing rather meanly.

Then they too vanished from Crete. More volcanic ash fell, and the land became unproductive. Crete remained, a small backwater with memories of greatness, as she is to this day.

Many scholars do not accept the equation of Thera with Atlantis, but many do. The similarities seem too great for pure coincidence. For example: although there is no known legend connecting Theseus of Athens with Atlantis, it seems almost certain that Theseus met his minotaur in a bull fighting ring at the great House of the Labrys, the House of the Ax, or Labyrinth, in Knossus.

Poseidon was the god of the Minoans, as well as Theseus' special protector. The Atlanteans were the Sons of Atlas, son of Poseidon: Poseidon the earth shaker, who "delights in bulls" according to Homer; and Plato tells how the kings

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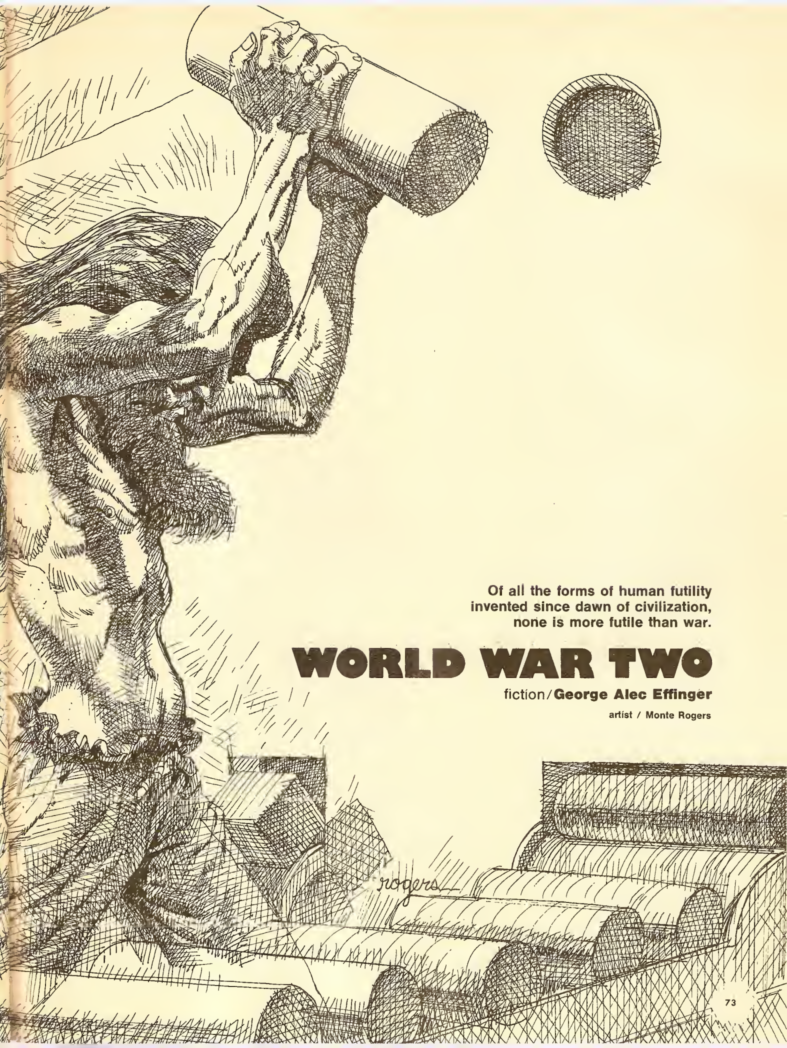

Of all the forms of human futility
invented since dawn of civilization,
none is more futile than war.

WORLD WAR TWO

fiction/**George Alec Effinger**

artist / Monte Rogers

So the great vessel departed, out into the vast monotony of the Atlantic, on its way to the superior charms of the old world. Seven days later it sank.

Thomas Dane Tungsten bought a ticket for a cruise liner in August of 1935. It was for one of the huge German ships that were encouraging Americans to come on over to Europe, to see the sights, to spend lots of dollars in foreign ports, to make fools of themselves and destroy their nation's hard-won image overseas. This was a few years before the European crises became fatally tense, when everyone still delighted themselves with thinking that all the Germans would soon get back to writing heavy operas. With characters like Mussolini on the horizon the idea of war seemed terribly remote. At least, T. D. Tungsten thought so. He could never remember just what the Germans were doing in 1935. It was between the burning of the Reichstag and the breaking of the Locarno Treaty; for a lot of people who weren't paying close attention those years are a shadowy loss. But Tungsten wasn't worried about the situation, and so the political details of the background aren't important.

The ship was huge. Tungsten was a little frightened when he first saw it, tied up at a pier on Manhattan's west side. There were long strings of lights running from prow to smokestacks to stern, rising up far too high into the sky for a pleasure ship. Well, the Germans had a reputation to uphold, and as long as the thing got him safely and comfortably to Bremen he needn't worry overmuch about its formidable appearance. He had no one to see him off, neither family nor friends, and during the mad leavetaking of the other passengers he could not decide whether to stand at the rail and wave indiscriminately or retire coolly to his stateroom. He compromised by standing apart, behind the crowded rail in the shadows, where he stared at the polished deck and sighed.

So the great vessel departed, passing beyond the Statue of Liberty's electric welcome, out into the vast monotony of the Atlantic, on its way to the superior charms of the Old World. Seven days later the ship sank.

There was little of the Hollywood ship-sinking scenario: sweaty, fat crewmen working feverishly below decks, steel plates buckling, lights flickering from sockets swinging overhead, streams of water beginning to squeeze in through weary joints, passengers running to lifeboats, grim-faced officers working out their private dooms, great phony-looking waves, storms, cries, human dramas. Tungsten actually slept through most of it all, and when he emerged from his tiny quarters everyone was already running back and forth carrying children. He stood there blinking for a few seconds. He yawned, trying to figure it out; then the ship hit something and he was in the water. He nearly drowned but at last didn't, and woke up on a sandy beach.

That was the part that made the whole experience palatable for him. It wasn't often during his life that he had some silly notion vindicated. He used to look on a map and wonder about the Atlantic Ocean. Having grown up on the Jersey shore his thoughts naturally tended to the mysteries of the sea. So he used to notice that while the Pacific, immense and unchartable as it is, was still known to be well-populated with bands of islands—from the Aleutians to the Hawaiian to the Philippines and Indonesia, and the scores of smaller groups, let alone the atolls and microscopic, barren rookeries—the Atlantic was given as a sterile blue-gray, with only the Bahamas hugging North America for features. This seemed wholly unlikely to T. D. Tungsten's romantic mind, and he was sure that if anyone would take the trouble there were rich discoveries to be made. Unconscious, clinging to a floating spar, he made one of them himself.

At first his new home looked unexciting, as islands in the North Atlantic might be imagined. There were no birds wheeling in the sky above, no swaying palms fringing a jungle at the edge of the golden sand, no ribbon of water splashing down from the rocky heights far inland. It was cold and grey. Cold, grey water lapping around his ears; cold, grey sand beneath his back; cold, grey boulders tumbled up only a few yards from the ocean's edge. He stood slowly, his back and legs punishing him with stabbing cramps. His chest still ached, but, Lord, T. D. Tungsten had never been that hungry in his life. So he walked along the beach, searching for a place where the rocks had left a passage into the island's interior. He didn't find one.

He grew almost despairing; he indulged himself with thoughts of romantic death, of a poetic ending that belied his meager life. If only he could promise himself the self-possession to put his body down in its last, starving seconds

A small section of the table's top slid back. A little elevator rose to fill the vacated space, and on it was a plate with a hefty chunk of chocolate cake.

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in some fantastic pose. He had a lot to learn about himself as a man; he enjoyed the experience in a macabre way, either because he still didn't accept it or because he was, after all, not a wholesome person. But he entertained himself with these things until he caught sight of the building.

It was a massive, white stone edifice, fitted so snugly among the stony cliffs of the island that at first it appeared to be carved from them. There were no windows visible as Tungsten made his way closer. The building was organized into layers; the first story rose straight up for twenty feet, the second was set back a bit, the third even more, ziggurat-style. Tungsten went up to the white wall and touched it. The stone was smooth and clean, brightly flecked with rose-colored minerals. There was no legend or plaque mounted on the wall, no signboard to give a clue to the building's purpose. He stood wondering for only a few minutes, and then at last began searching for a way in.

He didn't find a door. In fact he never found so much as a seam indicating where an entrance might have been concealed. The building was well-made, and soon Tungsten guessed that its builders didn't want him to learn certain things. He knew he wasn't going to outsmart them, so he gave up. He did discover, at the far eastern end of the building, a strange sort of mechanism. There was a kind of rack which ran out perpendicularly from the building and curved down into the ground. On the rack were several pointed cylinders about a yard tall, standing up on their flat ends. Above the point where the rack of cylinders met the wall there was a round hole about five inches in diameter.

Tungsten investigated the rack and cylinders as closely as he could without touching anything. At last his confidence increased enough to permit him to pick up the first of the cylinders and examine it. Like the building, it had no identifying features, no stamped numerals, no manufacturer's name, no instructions or warnings. The cylinder was heavy enough to tire his arms after a while. Tungsten went to put it back on the rack, but to his surprise found that the other cylinders had moved up by means of a sort of conveyor belt; a new one had appeared out of the ground to fill the gap. He did not know what to do with the cylinder; he glanced around and saw the hole in the building's wall. He saw immediately that it was about the same size as the diameter of the cylinder. Certainly that wasn't a coincidence. He pushed the cylinder into the hole; it went in about halfway, and then there was a loud click. Something inside the wall hummed, the cylinder rotated one complete turn, there was a soft *pop!,* and the cylinder disappeared inside the wall.

It was more amusing than bewildering. Tungsten was nearly weary of his experimentation, but he pulled another cylinder from the head of the line. He watched the rack move forward on its belt. Another cylinder appeared out of the ground; he couldn't tell if it was the one he had just put into the hole. His tired arms rebelled at holding the new cylinder, and he dropped it to the ground. There was an immediate reaction. The thing began wailing in an irritating siren voice, which grew ominously louder. There was also a noticeable bomblike ticking. Tungsten stooped and picked up the cylinder, and flung it as far as he could. There was an explosion, large enough to shower him with dirt and rock. A few fragments of the cylinder's casing spanged off the wall, but none hit him.

T. D. Tungsten shuddered. He turned his back on the rack of cylinders and started to walk away, but the siren and the ticking made him turn again and run. The first cylinder on the rack was demanding attention. He picked it out of the rack and ran with it a ways, then threw it toward the water. He dropped to the ground, and the explosion did no more than the first toward damaging his person.

A whirring of the belt informed him that the cylinders had moved up again. Knowing pretty much what was expected of him and what would happen if he didn't hurry, he took the new first cylinder and pushed it into the hole in the wall. It hummed and turned, and disappeared, and Tungsten reached for the next one. He had found a job.

He worked for hours without rest, until his weary arms couldn't lift another cylinder. He stopped, dropping down to rest on the grey sand at the base of the building. In a few seconds the next cylinder began shrieking its warning, and Tungsten sighed. He grabbed it and shoved it into the hole in the wall. The siren stopped, the cylinder hummed and was accepted into the mysteries beyond the building's perfect front.

The island was as much a puzzle as it had been on his arrival, and tied to his mindless chore he despaired of ever learning more. If he walked away from the rack, the first cylinder would detonate before he could go very far; he feared to test the effect of allowing that single bomb to set off the others. It was simpler just to push the cylinders home than to worry about escape, except that he had no way to communicate to the vast white wall that he was desperately tired.

He let another cylinder wait until the last moment. Its ticking grew louder, the siren's scream more shrill, and finally he lifted it to its goal. After its disappearance the rack remained silent. The cylinders didn't move up a position. Tungsten watched for a few seconds, panting. There was a space where the first cylinder should have been; minutes passed without the ticking or siren. Tungsten was just about to fall to the ground again when a panel opened in the white wall. It slid open quickly, noiselessly, very near the cylinders' arcane socket.

It was getting late. The sun was setting behind a jumble of grey rocks to his left. The opening in the building's wall was like a dark cave; Tungsten could barely see in, but he entered with little fear. He followed a narrow corridor for a short while, until it led him to a huge, dimly-lit cavern. Hundreds of tables were arranged in rows, filling the floor of the immense hall. The ceiling was invisible in the shadows overhead. At the far end of the chamber the wall was covered with thousands of tiny plastic doors, with objects behind them. From that distance Tungsten couldn't tell what the objects were. He started to walk across the tiled floor of the hall, but he made such an echoed clamor that he dismayed himself. He sat at one of the tables instead, to collect his dreamy thoughts and rest his tortured body.

As soon as he sat, a light went on behind one of the uncountable plastic doors. There was a vague whirring of machinery, and a small section of the table's top slid back. A little elevator rose to fill the vacated space, and on it was a plate with a hefty chunck of chocolate cake.

Tungsten was delighted. Apparently his physical needs were going to be taken care of. Well, that's all that anyone can ask. Knowing that, he wasn't nearly as fearful about his future. He didn't even mind his job as much, underpaid though he was. He assumed that access to this food was determined by a certain amount of labor, and later experimentation proved him right. At the age of nineteen he had moved away from home and gone to Toledo, where he

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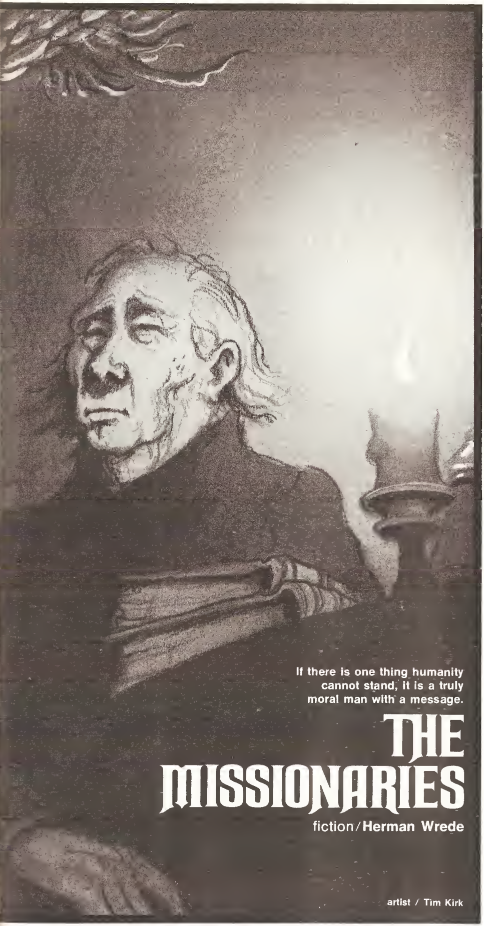

If there is one thing humanity cannot stand, it is a truly moral man with a message.

THE MISSIONARIES

fiction/**Herman Wrede**

artist / Tim Kirk

Rise, John Snell; do not be afraid." The words were flecks of quicksilver coursing through my brain until they merged into a shining globe of consciousness.

I opened my eyes. They were no more human than before, but they were not wavering in outline as when they suddenly appeared in my meadow to affright my cattle and plunge me into a deep swoon.

"Rise, John Snell," the older said again, and I struggled to my feet as they stepped back. They followed me into the cabin, where I sank onto a stool and gathered courage to speak.

"What do you want with me?"

The older bowed. *"We are missionaries, John Snell. Our home is across the stars in distances so vast it is beyond your senses to comprehend."*

"Missionaries? To my world?"

"And others," said the younger. *"We have been to many worlds. Some did not require our services. Others had, but it was too late. We have reached your world in time."*

"I do not understand."

"Your world is racing toward self-destruction, John Snell," said the older. *"In every land, men lie, cheat, steal and kill for power, gain or jealousy. We have seen the pattern often in planets that now turn in eternal silence through the night. You have been chosen to prevent it here."*

The words shook me to the core of my soul. "But I, what can I do? I have no skill in oratory or wealth or influence to sway the minds of others."

"You are a man of good heart," said the older. *"We observed you for a long time before we made our presence known to you. As for the doing, give heed."*

What he told me then was wonderful. Long after his words were ended, I sat transfixed at the simplicity of it. I would tell men and they would tell others, until it spread through every land. Peace and happiness would dominate the world. Tears of joy filled my eyes.

"It can not fail," said the younger. *"Will you do it?"*

"I will!" I cried from the fullness of my heart. "I will begin this very day Bless you. Bless you forever!"

They bowed and began to fade until I could see the boards of my cabin through their bodies. As their outlines disappeared into nothingness, I caught the echo of their departing words: *"Goodbye, John Snell; we will not come this way again. Goodbye."*

I am writing this down while the glory of the miracle still pulses through the cabin. The world will change from this day forward, and future generations will look back to the year 1692, burning like a beacon across the centuries. And now, I must hurry into Salem to begin my ministry. ○

ATLANTIS FACT OR MYTH?

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of Atlantis gathered to sacrifice bulls to Poseidon . . .

We have no idea of what the Cretans called themselves. We say "Minoans" because legend says they once had a king named Minos. It is as if future archeologists called America the "Washingtonian Republic" or the "Rooseveltian Empire." It is not absurd to believe the Minoans called themselves the "Sons of Atlas."

The evidence for and against Atlantis-as-Thera takes up many volumes and many pages in academic journals. Those interested should go to recent issues of *Antiquity,* and see the books published by A. G. Galanopolous, J. V. Luce, and Sir Denys Page. For myself, after months of study, I am convinced that Atlantis has been found; but the identification points to the truth of another and even more incredible story.

The study of the Bronze Age is both more rewarding and more frustrating than any other kind of archeology. Prior to the Bronze Age there were no written records. Potsherds, kitchen middens, and graves; the testimony of the spade, is very nearly all the evidence we will ever have. After 900 BC there are legends and records in plenty. Between 1000 BC and 1700 BC, however, there is a period in which potsherds and bones can be fleshed out by legends, if only we can interpret them properly. Legends may contain history, but it is veiled history wrapped in myth.

Many historians want to discount legends entirely, as does a prominent school of archeology. Few believed in Troy until Schliemann dug it up. The same was true of the great Hittite Empire, and of the great Empire of Minos until Evans excavated it at Knossus. If Thera was Atlantis, as I now believe, we have one more indication that there is truth in the old legends. Interpretation can never be exact, but we may find reasonable explanations for myths.

For example: Talos, the bronze man, who defended Crete against enemies; couldn't he have been the commander of a bronze armored guard? Barbarians seeing armor for the first time would think of him as a monster. And one of Talos' jobs was to display the law three times a year throughout the Empire—much as a British Justice of Quarter Sessions travels about holding court.

The Biblical Plagues of Egypt sound very like the course of a volcanic explosion. There is a rain of blood—iron oxide, poisoning the streams? A hail of fire would follow as hot ashes fall. Lightning invariably comes with eruptions as ionized gasses spew forth. Locusts and frogs are common in Egypt today and would tend to swarm after the ashfall. Even the Angel of Death who struck the "Firstborn of Egypt" is hardly fantastic when we recall that "Firstborn" in Hebrew also means "Chosen" or "Most Important." A great earthquake—and earthquakes have accompanied the modern eruptions of Thera—might easily kill the "Firstborn" in palaces, while sparing nomads in their tents.

It has always seemed unreasonable that the Exodus, so vividly described, which traditionally made the Children of Israel a people and was the origin of the Passover, could be pure fantasy.

According to Plato, when Atlantis sank it left behind shoals so that ships could not visit the island. When Krakatoa blew up in 1890 the Sunda Straits were filled with floating islands of pumice stone so thick that sailors walked on the sea. Old legends say there were once floating islands in the Aegean, and the Egyptians told Herodotus of an island that floated into the Delta. This could be a tall tale; but one of the largest islands in the Mississippi was formed when mud washed around the hulk of a Civil War gunboat. Pumice could easily have floated to the Delta from Thera, and the Nile is no less efficient as a mud carrier than the Mississippi.

And so on. The great Empire of Atlantis destroyed by the eruption of Thera will account for dozens, hundreds, of puzzling legends. Dr. Littleton of Occidental goes even farther. He believes that prior to the Thera disaster, western religions were similar to those of the east, with God intervening only through creation and cycles. It is only after the catastrophe of Atlantis, he believes, that western man came to think that God moves in time to cause particular events. Thera can explain much, and it was, after all, the most cataclysmic event we can prove to have happened since man appeared on earth.

Yet, there is a severe problem. The chronology is wrong. Sir Denys Page has proved that although Crete fell in a short period of time, probably due to the Thera eruption, the Empire of Minos died by fire, not water. There were no tsunamis across Crete when Thera exploded. This is not unreasonable; we can only be sure there *were* tsunamis, not of their direction.

Thera exploded about 1450 BC. Fifty years later the Mycenaean Greeks—Homer's Acheans—flourished as never before. Thera had very little effect on the Mediterranean basin. Cultures rose; then, very suddenly, something happened about 1150 BC.

In that later year the entire civilization around the eastern coast of the Mediterranean vanished—and it vanished quickly. There is evidence of monstrous—but undated—tsunamis. Pumice has been found washed as high as three hundred meters above sea level, and kilometers inland. (When Krakatoa blew up, a Dutch warship was stranded 11 kilometers inland.) There were tsunamis on Crete, but definitely long after the Thera disaster.

Following the end of the Trojan War around 1250-1200 BC, the whole Heroic civilization vanishes. Cyprus, Rhodes, Palestine, Lebanon, North Africa, Greece, Crete, the Cyclade Islands, Asia Minor—everywhere there is sudden disaster. It is sudden, and it is permanent. The period from about 1100 BC to the beginning of Classical Civilization is a true Dark Age.

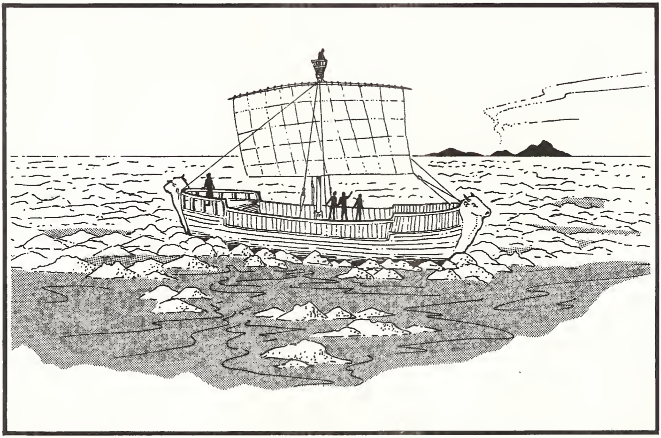
By 1100 BC the art of writing was lost except in Egypt. The traditional explanation, invasion by nomads, is simply insufficient to account for a disaster of this magnitude. As Leon Pomerance of the Archeological Institute of America has shown, this was catastrophe on a grand scale; nomads simply couldn't have been efficient enough in killing off millions of people.

Nomads there were; but what is cause and what is effect? Pomerance thinks they were refugees. Certainly hordes of displaced peoples wandered the seas looking for a place to live. Twice the Peoples of the Sea invaded Egypt, and both times they were defeated in great battles requiring the full power of the Egyptian Pharaoh. The remnants of the Sea People included the Phillistines—people of Crete, according to the Bible—who settled in Palestine. Interestingly enough, although they were sea people, they built their cities in the highlands, as if they were afraid of the sea.

This is the probable century of the Exodus; at the time of the Thera disaster, Thothmes III, Thothmes the Great, Thothmes Conqueror of the World, whose borders extended from the cataracts of the Nile to the Euphrates River, ruled in Egypt. It is nearly unthinkable that the Israelites could have escaped this most powerful of Pharaohs. By 1150, though, the great dynasties had fallen, and the Exodus could have taken place.

But Thera erupted in 1450 BC. It is at least 2 centuries too early. Was there

After the eruption immense floating islands of pumice would have blocked the sea around Thera, the shoals and mud of which Plato spoke when describing the destruction of Atlantis.



another volcano, one not yet discovered because it is lost beneath the Mediterranean? It seems unlikely. Yet the evidence for volcanic disaster and tsunami floods is so great that Pomerance, in defiance of every bit of archeological and radio-carbon evidence, insists that Thera must not have erupted until 1150; he can account for the Dark Ages in no other way.

My correspondence with Sir Denys Page, Master of Jesus College, Cambridge, convinces me that Thera exploded in 1450 BC. There is no evidence for another volcanic explosion in 1150. What, then, could have caused the disaster that exterminated Homer's great Achean civilization only decades after the triumph at Troy?

The same Egyptian priest who told Plato the story of Atlantis said that long after the Fall of Atlantis Phaeton drove the chariot of the sun too close to the Earth. The world was scorched with fire, and after that there were great floods. Greek legends tell of the flood of Deucalion, a flood that killed all men but two. They tell of fertile plains washed across with salt water so that the land would no longer grow crops. This flood was associated with Phaeton.

If we believe the Atlantis story, those old legends take on a new validity. If Atlantis has been found on a volcanic island, and I believe it has been, then there might we find the remains of fiery Phaeton, the Chariot of the Sun, which came to Earth to scorch it beyond endurance and afterwards caused the floods?

Is it possible that an enormous meteor struck the Mediterranean basin sometime in the Eleventh Century before the Christian Era? I think it likely.

BIBLIOGRAPHY

Berlitz, C. *THE MYSTERY OF ATLANTIS* / New York, 1970

Carpenter, R. *DISCONTINUITIES IN GREEK CIVILIZATION* / Cambridge, 1964

Eichner, H. *ATLANTEAN CHRONICLES* / Alhambra Calif., 1971

Evans, A. J. *THE PALACE OF MINOS AT KNOSSOS* / London, 1921

Galanopolous, A. G. and Bacon, E. *ATLANTIS: THE TRUTH BEHIND THE LEGEND* / London, 1969

Hood, S. *THE HOME OF THE HEROES* / London, 1967

Hood, S. *THE MINOANS* / London, 1971

Hutchinson, R. W. *PREHISTORIC CRETE* / Harmondsworth, 1962

Luce, J. V. *LOST ATLANTIS* / New York, 1969

Marinatos, S., and Hirmer, M. *CRETE AND MYCENAEA* / London, 1960

Page, D. L. *THE SANTORINI VOLCANO AND THE DESTRUCTION OF MINOAN CRETE* / London, 1970

Palmer, L. R. *MYCENAEANS AND MINOANS* / London, 1965

Palmer, L. R. and Boardman, J. *ON THE KNOSSOS TABLETS* / London, 1963

Pendlebury, J. D. S. *THE ARCHEOLOGY OF CRETE* / London, 1939

Platon, N. *KAKROS* / New York, 1971

Pomerance, Leon *"The Final Collapse of Santoriini (Thera), 1400 BC or 1200 BC?"* / Paper delivered to the International Scientific Congress on the Volcano of Thera, Athens, 1969

Taylour, W. *THE MYCENAENS* / London 1964 ○

THE BIOGRAPHY OF A STAR

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The Ring Nebula in Lyra is another example of a cloud of escaping gas, the debris of a star which has either novaed or supernovaed. As the cloud of gas expands it will mix with interstellar hydrogen clouds, and eventually form a second generation star.

Before long, under the impact of the increasing radiation from within, the star's outer layers begin to boil and expand. The star swells immensely, but the outer layers, pushed farther and farther from the fusion furnace inside, begin to cool. Before long it becomes a red giant, with a relatively cool surface, only some 5,000 degrees, as compared with the 11,000 degree surface temperature of our sun, but, because of its size, it is radiating energy at a tremendous rate.

As more and more hydrogen fuses, more and more helium piles up in the core, which gets hotter and hotter as more and more pressure is required to offset the increased gravitational attraction of the building core. Finally, almost as if in desperation, the helium, at a temperature of some 200 million degrees, begins to fuse, three atoms coming together to form carbon, a fourth being added to make oxygen, and even a fifth to form neon. In combination all these reactions generate intense gamma-ray energy, transforming the star's core from an evenly heated supercrushed gas into an active vibrant gas, hotter at the center where the new reactions are occuring than in the skin where hydrogen fusion is still taking place.

This helium flash, often called the "core pop," is like an explosion in the center of the star, but that explosion is usually damped out by the star's immense gravity and the surrounding layers of fusing hydrogen, acting as a sort of shock blanket. So the star begins to burn on two levels, hydrogen on the outside and helium on the inside, with a carbon-oxygen-neon "ash" core being formed. This too eventually pops, and soon the star will start building a magnesium core, then a silicon-aluminum-sulphur, and finally the star will be made up of many shells, each burning a different fuel, from hydrogen on the outside to iron at the core.

The fusion reaction which creates an iron ash takes place at some four billion degrees, and this temperature releases a fantastic amount of neutrinos, which easily escape from the star's gravitational field. The star must shrink to fill the void being left by the escaping neutrinos, and the core gets hotter and hotter, reaching some twelve billion degrees within a matter of weeks from the time the iron reaction starts. At this temperature an entirely new reaction takes place. Atoms no longer fuse, but instead break down, the carbon-through-iron ash, which has been fusing, suddenly breaking down into helium nuclei, and, in so doing, absorb energy instead of releasing it. With the internal explosive pressure ended, the outer layers rush inward under the terrific, uncompensated force of gravity, and in falling the outer hydrogen-burning, helium-burning and oxygen-burning layers are all jammed together and in a matter of seconds the entire remaining nuclear energy remaining in the star is released at once, in the horrendous explosion we call a supernova. What is left of the star is a rapidly expanding cloud of gas, made up of almost all the elements but heaviest in those above iron on the periodic table, and possibly a small, blue-hot core of iron, the remnant of a star which exists no more.

But, while the star may be gone, the elements of which it was made still exist, if in somewhat changed and attenuated form. And, just as the immensity of the universe and the tremendous amount of matter in it guaranteed that atoms would fall together, eventually to become suns, so it will happen again, this time with a slightly different cloud of atoms.

Atoms will begin to approach each other, first because of light pressure then because of gravitational attraction, and, just as the hydrogen cloud condensed into a red giant, so now will the explosion cloud condense into a blue or yellow star, smaller and hotter, and, fortunately, somewhat more stable. This star will be much richer in metals than the parent star, which was primarily made up of hydrogen. This "second generation" star is the type of sun our planet, Earth, circles.

Our sun is also a hydrogen-fusion furnace, and it will also go through the same ash building — core popping sequence of its parent. It, too, might supernova, eventually giving birth to a third, or even fourth, generation star. In fact, some astronomers have postulated that the sun, our sun, might be a third or fourth, or even fifth, generation star.

Another alternative is possible, though. Eventually there will come a time when the internal balance of the sun will be maintained without the nova or supernova explosion. What happens is that when the iron-to-helium breakdown begins, and the outer layers of the sun rush downwards under the tremendous gravitational at-

The Crab Nebula in Taurus is the remnant of a supernova, the light from which reached Earth in 1054 A.D. Below is a globular cluster of young stars.

traction of the core, the contraction happens so swiftly that the energy produced by the collapse is enough to feed the iron breakdown, and instead of an explosion we end up with a white dwarf.

Normally white dwarfdom, a star as heavy as our sun but only a tenth its size, made up almost entirely of degenerate gas, is the end of the road. Slowly, over billions of years, the gravitional energy is used up, until finally there is only a dead, non-radiating body — a black dwarf — left.

But, under certain probably very rare conditions, which appear to have happened only between 50- and 100,000 times in our galaxy, the star can continue to contract, past the white dwarf stage, to a point where the particles, all the particles, which make up the sun are so crowded together that they become neutrons, actually touching each other. This would give a star-mass body only ten miles or so in diameter, with a temperature of perhaps a million degrees. That million degrees could not exist for too long, on a cosmic scale, however. And what might happen to the star when that energy loss becomes no longer possible?

Apparently the star can travel one more step down the evolutionary road. It can contract under gravitational compression to the point where the gravitational attraction of the star is so great that not even light can escape. At this point, to all intents and purposes, the star has ceased to exist in our universe, since we would be able to detect it only as a "black hole," a region of non-matter, non-space, non-anything except fantastic gravitational attraction. What further steps might lay beyond the star's collapse into a black hole we cannot, at this time, even speculate on. Black holes are, quite literally, beyond human ken. At least for now. ○

The bright young stars of the Pleiades and a slight nebulosity in Taurus show second and perhaps third generation stars near the mid-point of stellar life.

THE DEATH OF LIFE

from page 39

Life stood nearly six feet. He was wiry, an unusually big jaw, hair and eyes a deep black. His movements were remarkably fluid. He was both an experiment and companion. Earlier in his career Finchman produced some brainy scientific equations. Stuff which only a selected few could grasp. Could Finchman pool all his knowledge, all his recondite equations, and actually create? He could—and did. Life, as he was aptly named, was helpful, too. He could have been taken for a butler. Although Finchman never thought of him that way.

Life bore the curiosity of a child. His inquisitive nature would range from "Why is it raining?" to "Am I like you?" Curiosity or not, though, he was a marvel in creativity. His ability to talk, to mention nothing of his aptitude for games, indeed his very existence, was truly astonishing.

"Your bid," Finchman said, studying the cards in his hand.

"Two."

Finchman nodded go-ahead and Life slapped a card on the table. The play ended there. Finchman closed his eyes in silent pain with fingers kneading the temples.

"That's all for now," he finally told Life.

The attack was not uncommon to Finchman. Frequency increased as time went on. It had been the third one that week. The symptomatic pattern never detoured. First the aching and steady throbbing in the head. Then the chest, pained and heavy, reacting to it. Seventy-two years old. That, Finchman knew, was the diagnosis. Old age was killing him.

A month later, after several more attacks, and much contemplation, Finchman called Life to his side. "You've been around quite some time now," he said pensively. "When I die, you, too, will die. Understand?"

Life nodded mechanically. "Yes," he said uncertainly.

"The problem is," Finchman continued. "I haven't really decided how you shall go."

"Go where?"

"Try to understand," Finchman coached, taking the pipe from his mouth. "You don't remember what it was like before I made you. Right?" Life nodded vaguely. "Well, that's where you're going. Back to the place you were at before I made you. A kind of no-where land you might say."

"Must I go?"

"Yes. Without me no one would watch over you. No one would know how to take care of you. Like I've told you before. You're a fairy tale. One of a kind." He looked at the antique clock on a mantelpiece, a can of grease alongside it. "Time for your rest," he reminded Life.

He submissively departed, leaving Finchman to ponder. Life was a work of ingenious complexity and surely the thought of destroying him was loathsome. He was not a painting or literary work that could be enjoyed and related to. He was a figment, given over to science fiction stories—a fantasy concocted from the mind of a story teller. Were he granted survival, Finchman knew, he would be destroyed at the hands of someone else as a monster. The issue of Life's disposal had to be settled now. Another attack and it could be too late. Finchman made up his mind. There'd be no more delay. Life would go immediately. The method? The ax—albeit messy—seemed about the best. There were other ways, but Life would have to be chopped up, anyway, before being burned.

The mantelpiece clock chimed the arrival of a new hour and, placing his pipe in the pocket of his vest, Finchman rose resolutely to his feet. He started toward a closet door across the room. He opened the closet, reached into the darkness beyond, and took out the method. He felt the ax blade gingerly with the tip of a finger. Life's head could be severed easily.

The climb up the stairs, leading to Finchman's chef-doeuvre, was tiptoe. When he did reach the top he could see his victim plainly, the room illuminated by a single lamp. He was not resting, as he should have been, but was standing—back to Finchman—peering out the room's oval window. The stars in the night sky apparently held his interest.

Ever slowly, like a cat skulking its prey, he moved toward the back of Life, his eyes fixed on his neck, the ax in ready position. The floor creaked and Life turned, side-stepping the clumsy swing of death that missed its mark. Finchman swung again and caught a chunk out of Life's forearm. Blood gushed from Life's wound and excruciation distorted his face. He was grunting, panting, fighting back. Finchman swung again, this time catching a piece of shoulder. More blood. He swung again, missed, and lost the ax. His head began to throb—so much that he clutched at his temples. A stab of pain in his chest. The attack. Not now, his mind begged. Life laboriously picked up the ax, his body drained of strength and blood. Finchman was still clutching at his temples with closed eyes when Life managed to swing the ax, make contact with Finchman's neck, then fall face down and drown in his own blood. He did not see the head of his creator fly through the air and then roll down the stairs.

Finchman was ready for the junk yard. Wires, springs, bolts, two coils, scattered about the room. He was totally beyond repair. Life, too, was totally beyond life. He was ready for the graveyard. Only on this planet there was no such thing. O had spent fifteen years copying statistics; he supposed that he was due for a change. His new position got him out into the fresh air, plenty of sun, good exercise.

Except that the cake was awfully stale. The chocolate frosting fell in hard scales to the plate, making shuddery clatters in the stillness of the hall. And there didn't seem to be anything to drink. He waited and waited, but the plastic doors remained dark. He got up and sat at another table, but nothing happened. At last a warning gong began to sound, loudly in the deepening gloom. Tungsten stood and ran from the chamber. He followed the corridor back outside, and there found a clear space among the rocks to sleep.

In the morning he was awakened by a loud siren. He had a terrible thirst. There were pools of rain or dew in the shallow craters of the rocks, and he licked these up crazily. They barely satisfied him, but soon he realized that searching for more would be wasted effort. He hurried across the sand to the rack of cylinders. Sometime after he had gone to his meal the previous evening they had jumped forward, and the first cylinder sat waiting for him to begin. He lifted it up and pushed it into the hole. Behind him he could hear the rack's belt and rollers creak into operation. The day began.

And the day passed, ending at last with another meal of stale chocolate cake. Tungsten fell into a dependent apathy, working at the cylinders in order to get his daily ration. The food changed every three days. After the chocolate cake he had a bowl of cold navy bean soup for three days, then chipped beef on very hard toast. In the mornings he lapped up all the water he could find, and he never had time to explore his prison further.

One day he heard a voice. He looked up from the rack of cylinders and saw a naked man wading out of the ocean. "Hey," said the man, "what the hell is this?"

"Don't know," said Tungsten. He turned his back on the newcomer, lifting the cylinder to its socket in the wall.

"Look, who's in charge?"

"I am," said Tungsten, reaching for the cylinder which had moved up to take the other's place.

"Well, look, I want to get a telegram home or something," said the man.

"So would I. Would you mind standing over there? You're in my way. If you make me drop this thing, we'll both be blown to pieces."

"What is this? You work for the Army?"

"Naw. Wish I did."

"All right, you don't have time," said the other man sarcastically. "Who else's around here that I can talk to?"

Tungsten turned around to look at the man. The stranger was short and plump, burnt red by the sun, crusted with a white rind of salt. He stood shielding his eyes with one hand. Before Tungsten could answer the cylinder began its siren warning. He moved quickly to push it into the hole.

"I said, who else can I talk to?" said the naked man.

"Nobody," said Tungsten. "Nothing you can do. Just sit down, you can come to supper with me."

"Nobody? You're all alone? What's the matter, don't you know there's a war on?"

"What war?"

The new man sighed and moved into the sparse shade of the boulders. Tungsten continued to work, stopping only for the short break the cylinders allowed him each day at noon. He sat down next to the naked man; T. D. Tungsten was tired, unwilling to talk to this absurd invader. Finally the stranger broke the silence. "My name's Staefler," he said. "This sunburn hurts like hell."

"What'd you do, fall off a ship?"

Staefler swore under his breath. "It's a long story," he said. Before he could begin it, the cylinders called Tungsten with their siren. Tungsten waved to Staefler and walked away.

After he pushed thirty cylinders into the hole, Tungsten forgot about the stranger. He had developed a series of fantasies that occupied his mind as he worked beneath the Atlantic sun. What did these uncanny things do on the other side of the wall? Maybe there was a moving belt behind the white blocks, too, carrying its load along the inside face of the wall, a load of human beings assembled by the builders of the machines. The cylinders would pop through the hole, extending a mere eight inches past the edge on the other side, through the skin, the ribs, the heart of the person behind the wall. Maybe there was a poor fool like Tungsten on the other side to catch the corpse and pull the cylinder through, again and again. . . .

Tungsten laughed. He lifted the next cylinder up and into the socket. He watched it disappear, to lodge halfway into the body of an Irish Catholic, a Jew, college professor, Negro, Communist.

The sun filled the western sky and settled down toward the pile of boulders that marked the end of the day's work. At last the cylinders allowed him to quit, and Tungsten joined Staefler. The invisible door opened in the rock, and the two men followed the passageway to the dining hall.

When Tungsten and Staefler sat down, two plastic compartments lit up. A place before Tungsten opened and served him a large plate of cold string beans and slivered almonds. Staefler was astonished when the place in front of him slid back and presented him with two thick slices of Boston brown bread spread with cream cheese. There were tiny specks of mold on them.

The next morning Tungsten noticed that another mechanism had been erected at the opposite end of the wall from his rack of cylinders. It was not difficult to imagine that this was for Staefler's occupation. There was a tall, thick post about chest high. A heavy black sphere sat on top. Staefler picked it off the pillar and carried it to a hole in the wall, just a little larger than Tungsten's socket. When he put the leaden ball into the hole it sat there for a few seconds, then vanished with a loud *thunk!* Another ball appeared at the top of the post. Tungsten said nothing; he went to his own work. A siren from the other man's part of the beach followed by a loud explosion made him smile.

The machines had staggered schedules. It turned out that Tungsten saw Staefler only once every thirty-seven days, when their dinner hours happened to coincide. The first occasion they sat together quietly, having little to discuss. Staefler talked about Japs and Nazis, and Tungsten was bewildered. He had nothing to add to the conversation. According to the other man Tungsten had been on the island for eight years. Staefler refused to believe it. Thirty-seven days later Staefler rambled on about some time when he had been in a hospital in New Orleans, and this beautiful girl named Barbara had spent the night with him. The nurses didn't mind, but after that he never saw the girl again. Thirty-seven days later Staefler was already eating when Tungsten entered the dining hall. He sat at a different table.

Hot summers passed, cold Atlantic winters. Every day the two men worked at their meaningless tasks. Some time later another man arrived, shipwrecked while trying to row across the ocean. No machine appeared for him to operate, but two days later he was gone. Perhaps some secret door had opened to lead him to an unknown job inside the huge white building, because Tungsten saw him in the dining hall every forty-two days thereafter. He never learned the man's name.

In October of 1952 a younger man floated up to the beach. Tungsten pulled him out of the waves and took him down to the dim dining hall at the first opportunity. Tungsten was now fifty-one years old, and had been working faithfully on the island for seventeen years. The younger man's name was Corrica, and he was so frightened that he could not give a coherent account of how he came to be drifting about in the middle of the Atlantic. A door opened up on the building's second level, high over the beach. The black hole gaped in the pure white of the wall like an entrance to Hell, but Tungsten encouraged Corrica to try it. He had no idea how the youth could get up to it, and had no time to help him. He never saw the boy again.

Others came to the island over the years. There were twelve in their group when Auger arrived, in 1965. He was a tall, thin man, bald, with a heavy beard. He stepped cheerfully from the waves and greeted the four who labored on the beach: T. D. Tungsten, Staefler, and two other more recent castaways. They waved distractedly and continued their work. Among them they managed to explain the situation to Auger. He smiled and nodded pleasantly. He began to tell them of his plans. They didn't care to listen. He walked among them, trying to make friends.

"Your name's Staefler, eh?" he said.

"Yuh," said Staefler, lifting a heavy ball from the pillar and carrying it to the wall.

"There's a boy by that name playing baseball. Bo Staefler. Not such a common name. You know him?"

Staefler stopped for a moment and stared. "I got a son we called Bo."

Auger slapped Staefler's shoulder. "Yeah, well, he's trying to catch for the Indians this spring. But they got a guy named Azcue who looks to have it all sewed up."

"My kid!" whispered Staefler. "God, he was only a baby."

"How the Indians been doing?" asked Tungsten.

"Not so great lately," said Auger.

"I mean since about '35," said Tungsten.

"Two pennants," said Auger. He looked at the old man carefully. "You been here *that* long?"

"Thirty years, and they won *two* pennants," said Tungsten bitterly. "Ain't missed a thing."

Auger talked with them longer. He seemed amazed by their story, but promised them that the end was in sight. They told him that he was stupid. He joined Tungsten for supper. The next morning a new contrivance had been set up for his use, but he refused to operate it. He would not touch one of the transparent cubes and so set the whole thing in motion. Instead he stood on the sand and lectured the others. He told them he sympathized with their plight, and realized that they had lacked leadership, but that from now on they didn't have to be slaves. They had individual minds, consciences, imaginations, and they had to use them or surrender their humanity.

No one answered. There was only the slight mechanical speech of the machines, and the protesting noises of the men's weathered joints.

"What the hell?" shouted Auger. "I'm not going to fall in with you bunch of idiots! You're ready to spend the rest of your lives here. I'm not. I'm not going to bow my head for a lousy plate of garbage."

"You're going to be awful hungry," said Staefler.

"Anybody ever looked around?" asked Auger. "I'm going to see what else this island has." No one said goodbye.

He was back in three days, subdued in tone but not intent. "I hate you, Tungsten," he said. "I hate you for starting this whole thing. All we have to do is organize. If you *all* stop—"

"We must first kneel together in order to rise together," said Tungsten placidly. He was an old man now. He had lived thirty years beneath the sky, and he had grown into a spare, hard man. He had no more ambitions.

Auger shouted for another day, until his hunger caused his knees to collapse. Then, silently, he began pushing the transparent cubes into the square hole, up above his head where he had to stand on tiptoe.

They were rescued eight years later, in 1973. The island had been discovered by a network weatherman named Gary Wolfram, who noticed a tiny smear on the satellite weather photo five days in a row. A few months later the Navy sent a ship to investigate. All of the men on the island that Tungsten could remember were found and transported to the United States. The place was named Wolfram Island after the lucky weatherman, its position classified, and a team of specialists was sent to study it.

Thomas Dane Tungsten returned at last to his home in Toledo, thirty-eight years after he left it. No one remembered him, and he recalled little of his earlier life. The first thing that he did was contact an attorney to sue the German ship company, but the company had not existed since World War II, and, anyway, such a disaster as his, being an act of God, would find little sympathy and less restitution in the courts. "Well," said seventy-two year-old Tungsten with an angry cackle, "I'm glad they lost the war, then." He did not live much longer after that. ○

GEOTHERMAL POWER

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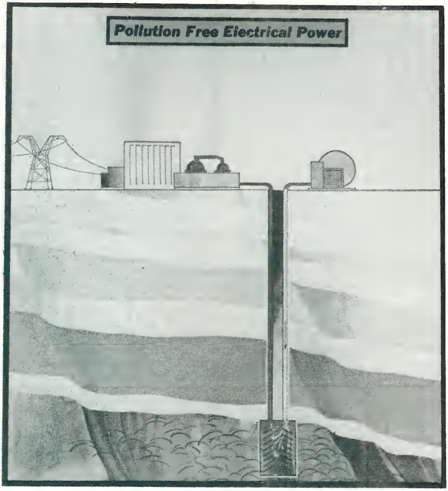

The geothermal exchange system envisions the utilization of geothermal energy without necessarily removing geothermal steam or fluid from the subsurface zones.

in the United States, houses in Boise, Idaho and Klamath Falls, Oregon employ the same principle to ward off winter.

Geothermal power enthusiasts usually have more in mind than simply piping warm water into buildings. They want to tap the steam in the magma reservoirs directly, funnel it to the surface and run electrical generators with it. This process neatly eliminates the coal and oil-fired boiler systems that currently account for about a quarter of present air pollution. And cutting out the fuel (not to mention the boilers) should theoretically reduce the overall operating costs. It sounds much too good to be true, like a violation of Robert Heinlein's famous dictum about "free lunches," but, surprisingly enough, it all works out pretty much in practice as in theory.

Roughly speaking, geothermal steam comes two ways.

Closest to the ideal are the dry steam fields, so named because the steam that comes whooshing out of the wells is at high temperature and pressure with no condensed droplets. After a simple filtration to remove dirt particles, the steam is fed directly into the generator turbines located on the field site. These operations are models of simplicity and economy; the "juice" from a dry field installation is produced at half the cost of a comparable coal-fired plant, and at one-third the price a nuclear station must charge.

The first geothermal powerplant was built at Laderello, near the Italian city of Florence, in 1904, and currently produces 358,000 kilowatts utilizing a dry field of steam with pressures of 70 to 400 pounds per square inch, at temperatures varying from 250 to 440 degrees F. The Larderello steam is somewhat unusual, for its source is not vaporized groundwater, but the underlying magma itself. It is difficult to conceive of molten granite containing *any* form of water, yet research has proven that, of the gases released by magma when it cools, as much as 79 percent is steam.

Aside from Larderello, only four more dry steam fields are known to exist; two are under Japan, and one apiece are in New Mexico and California. There may be more, somewhere in the vast Pacific "Ring of Fire," since geothermal activity is linked to volcanic actions in the Earth's crust, but for now no one is looking: Entirely different geothermal steam fields are being discovered these days just about everywhere on Earth.

When the magma reservoirs are not quite as hot as the ones producing dry steam fields, another form of geoermal power is created: wet steam fields. Here the water is raised well above boiling, but because of the intense ground pressure, it stays water.

Pumped to the surface, about 20 percent of the water *flashes,* or spontaneously turns into steam, while the residue remains a liquid just below the boiling point. For the geothermal engineer, these two separate products of wet steam fields may ultimately be more valuable than the steam from dry fields. Although the amount of steam from a wet field may be lower, the net operating pressure often is considerably greater—and can be increased by using special condensing systems that extract still more water from the steam. Wet field generating plants turn out more electricity, when all the specialized techniques are applied to them, than their dry field relatives can. The price tag is 25 percent higher—the unavoidable penalty for using all that expensive machinery—but because it can operate at a consistently higher capacity, a wet field plant can amortize itself in two ways.

The water that was initially separated out normally contains two to five percent brine together with other minerals considered undesirable in water. Employing modern desalting methods, which in turn depend on a steady flow of electricity to power the pumps and filtration gear, the water can be purified, cooled to acceptable levels and sold as fresh—

which it is. Canny engineers have hit upon an even more advantageous variation: instead of cooling the water in conventional towers which simply dissipate heat into the air, they plan to pump the still-hot water into special heat exchangers. These devices siphon off the heat by allowing the water to warm up isobutane (or Freon, as the Soviets and Japanese prefer), a liquid hydrocarbon that boils below 212 degrees F. The isobutane "steam" created by this method drives *another* series of turbines to generate more electricity; after the isobutane cools it is returned to the heat exchanger once again.

The technologically adventurous Chileans have proposed yet another arrangement to lower the operating expense of their new wet steam field plant at El Tatio. Not only will the station there be producing electric current and desalted water, but the leftover brine will be drained into evaporation ponds. Left to dry in the sun, the brine is expected to yield a harvest of valuable minerals.

In areas where the brine content of the water pumped out of the Earth is even higher, simply draining off the salty fluids is not enough. This is perhaps the chief problem confronting the developers of the Imperial Valley field. The content of dissolved salts and minerals is as high as one-quarter the content of water drawn from the Valley rock, and such concentrations have already caused some corrosion of the wells, the piping and the turbines of the small experimental plants funded by the San Diego Gas & Electric Company and several other organizations. Since the brine is toxic and cannot be released into any of the nearby rivers, finding ecologically-sound methods of disposal is a matter of no small urgency.

Probably the simplest technique would involve diluting the brine with sufficient amounts of fresh water to lower it to an acceptable level. But the already severe water shortage in the southwest states seems to preclude this attractive solution.

A far more ingenious proposal has been advanced by geothermal specialist Allen Van Huisen, which involves nothing more, or less, than an inversion of the normal geothermal steam generating procedure. Van Huisen recommends that the heat exchanger units that are usually located on the surface be lowered down the wellshafts into the hot brine reservoirs. Clean water, or some other "working fluid" would be pumped straight to the exchangers and be flashed into steam and sent via a second pipe to ground level turbines. The water could be recirculated to the exchangers constantly, thus neatly avoiding the problems involved in conventional geothermal plants which by necessity must transport the brine to the surface; Van Huisen's "Downhole Heat Exchanger" system would leave the brine where it is safest—buried under a half-mile of rock!

A geothermal smog and weather control system is possible through heat transfer from deep stratum to surface water to promote air-water temperature variations.

Geothermal sites which are not afflicted with the degree of salinity and mineral concentration of the Imperial Valley waters still have to contend with the long-term effects of operation. Even slight traces of salts and minerals in the steam cause scaling on pipes and turbine blade surfaces, as the operators of the first U.S. geothermal installations have found. Constructed over a dry steam field in northern California named The Geysers, a pilot plant run by Union Oil of California and two smaller firms has been researching this problem since operations commenced in the late 1950s. A gradual evolution in the basic techniques of well-cleaning and steam filtration has led from this effort, indicating that redundancy, or parallel building of important or easily-damaged machinery is part of the answer. Another is diversification and expansion of the facilities. Originally the plant generated current enough for a small town, but steady uprating with new equipment has raised the output to a city-sized 280 megawatts. Within ten years, when newer stations

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MAX

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handle that," Zuker said, grabbing up a slice of pizza. "Hauled him out of a dead-end model cities gig in Detroit. He'll do a good job for you, or else he goes back to the slums he's so scared of."

This was useless. Max got up. "You're no closer to conning me into this than you've ever been."

Zuker didn't move to stop him. "She'll be here tomorrow."

"I won't."

For the first time in at least a week, Max was enjoying himself. He was watching the fights with his father. Because it was only TV, cabled in from Louisville, Max missed the thick blur of cigar smoke, the raw strength of the bleachers, the single-minded rowdiness of the fans—realizing just then that he had once noticed these things. But they had beer and peanuts, cigars and easy chairs, and each other.

Max looked at his father with deep admiration. Stanley Kalubas was a stocky man, shorter than his son, nearly bald. His smile was an honest one—and not easy to bring forth. Max was sick of syrup-voiced people (on TV and elsewhere) who wasted the smile, an expression that should have meaning, on any trivial occasion. Max's father smiled at someone who *deserved* a smile.

He was smiling now, at his son. Max felt good.

The fights themselves weren't much. Over the years the dominant ethnic groups in boxing had been Irish, Italian, Black, Latin—now the newly-arrived Asians, largely at the bottom of the economy, were taking over the fight game sheerly by numbers. Max wasn't terribly interested in the match between Haroun Sheikh (white trunks) and Anand Krishnamurti (black).

In fact—he eyed the beer suds drifting down the inside of the glass as he drank—he wasn't interested in any fight that night. Why even watch a fight? Somebody wins, somebody loses. All the talk about technique, footwork, strategy and such doesn't matter. In a real fight, nobody cares about your style.

What was he thinking? Max had been a fight fan all his life! Was he questioning something that—was he—

He felt his mind getting too close (?) to something (like what?). He reached to anchor himself. "Dad?"

Stanley Kalubas turned, ready with the strength of fifty years. The TV glow edged him like dawn on a mountain range. "What?"

Max realized that he must have looked stupid—jittery, uncertain. "Have I been—a good son?"

His father smiled, and all evils were banished. "What a question! Sure, you're a good kid. Would I keep you this long if you weren't?"

Max smiled back. "I thought it was 'cause you needed a cheap number two man to drive the truck."

"Aw!" Stanley laughed, waving off the jests. Father and son looked to the fight once more. Security settled in Max as he leaned back in his chair; he was revitalized. He was still his father's son—there was nothing wrong with him.

Wow, that was fun," she beamed, "I've never been in a helicopter before."

She was tall. Taffy hair bounced around her shoulders. Gray eyes sparkled in a complexion flushed with excitement. Fresh features, but with overstressed dimples cut to deep smile lines around her mouth. The open bodice of her light blue dress showed firm, moderate breasts (on a mother of three?). She swung her handbag gingerly.

Zuker loped behind her, guiding her unnecessarily through Flint's tiny airport. They approached.

"You must be Max," she beamed.

What the hell was he doing here? He had no intention of going through with it. He wasn't even interested in seeing what his "mate" was like. But this morning, unaware of what he was doing, he had showered, shaven, gotten into some sharp-looking casual clothes, and drove out to the airport—leaving the truck, and the day's work, to his father.

"Max Kalubas, this is Stephanie Weidrich," Zuker said, "come all the way from San Diego to meet you, Max. Whaddya think?"

"I'm *so* glad to meet you, Mr. Kalubas!" the woman thrust a hand into his, trying too hard to be demure. But he didn't mind, really. Her perfume bored into his nostrils in just one certain way; he wanted to touch her, grasp her—

"Uh, welcome to Flint," Max coughed. Zuker started to smile.

They walked to the coffee shop, to get acquainted. He sat next to her, unable to take his eyes off her somehow-unspoiled nipples. She talked, radiating excitement.

". . . and when I heard, I was *so* glad I'd kept in shape. They've put me on fertility drugs, too, and I've never felt so alive in my life! The whole idea of giving birth to such a child thrills me—it gives meaning to my life as a woman . . ."

Max had an overpowering erection. There was fire in Stephanie Weidrich's eyes; she was ready. If he jumped her now, Zuker would gladly hold their clothes.

He shoved his chair back, wrenched himself up. He wheeled his bulky frame clumsily, bolted for the men's room. Safe, he masturbated vigorously, endlessly, overcome by the incredible appeal of her. He nearly passed out from the euphoria—there seemed no end to his potency.

Finally, he tumesced—shirt ringing wet, hair in his fingernails, breath shuddering into him. He was nearly too weak to lift his pants.

Zuker stood at the urinal, pissing casually. He chortled at Max, but said nothing. Max left the building, carefully avoiding the coffee shop.

That night, Brenda. A return to normal. They snuggled at a drive-in, with a blood flick on the screen and unabashed balling in (and on) the cars around them.

Brenda pointed at a couple intertwined on a blanket atop a red station wagon. "Wish I had the nerve to do something like that," she giggled.

He eased her closer, guiding her far breast. "Why? Y'might fall off."

"Oh, I don't know," she grinned naughtily, reaching into his pants, "I think I'd be pretty well—uh, anchored."

He had a hard on, in spite of this morning. It was as if he had spent the whole airport incident in another body. Slowly he put both hands inside her blouse. He worked his rough fingers carefully. She moaned.

She lurched her head back and tongued his ear. The hot breath quickened him; he dropped one hand to her slacks, eased inside, past her navel, hair, sweat, then soft indentation.

Sex in a car is a demanding practice; it has kept most of the contortive sexual positions in common use. To make out, half-dressed, in the front seat of a car requires perfect coordination of the partners—with elbows and knees strewn randomly. Who cares how our genes might go together, Max thought. Our bodies get along fine.

She stretched back across the seat, door to door. On the screen, someone bled to death.

Brenda shoved off her clothes. She fondled herself. "C'mon home tonight?"

Max grinned. "Sure. My pleasure."

She sat up and pressed against him. "Max—Max, I need you. I need you tonight. All the time." Her tears touched

With each flareup the flux of conflict sleeted through the Maxness—building up in him a pain beyond sensation. He screamed off torment, anguish, suffering—only to be immersed again. The content of the argument was forgotten—there was only pain.

his cheek.

"Honey—what's wrong?"

"Was she pretty?"

He frowned. "Who?"

"The woman they want you to marry. She got here today, I heard."

He swallowed. "Honey, how many times do I have to tell you? I'm not going through with that thing." But the vision of Stephanie came.

"Be with me tonight, Max," she murmured helplessly.

He wanted her to feel secure. He wanted to convince her, though he couldn't convince himself any more. He took her home, put her to bed, and—visualizing Stephanie—made love to her explosively. Dazed and reassured, she fell asleep.

Max sat next to her, watching her in the dark. Such a little kid, in so many ways. He had met Brenda Olszewski almost two years before, at a rock concert. She was an office girl for an income tax outfit; she had just moved to Flint a few months before, she had said, leaving her parents in Port Huron. He had never met them—and wasn't likely to. Brenda never talked about them—and whenever Max brought them up, she changed the subject. Eventually Max decided that Brenda and her folks just didn't get along. Since her past really wasn't his business, he stayed out of it.

He had been attracted to her right away—she was fragile and a bit dumb, which appealed to his ego. But she was an expert with an I. U. D.—and before long, a few turns in bed had become an assumed relationship. Finally he had come out and proposed.

He loved her. Didn't he? Then why was Stephanie so overwhelming? Why was Brenda's locket suddenly offensive to him? Why—?

He grabbed his head, holding in a rush of conjecture. He dropped back to the pillow and, eventually, slept.

H*e had been here before—in this same setting. But now there was a sharpness to things which had been absent before—and he almost remembered when that was.*

The confines were the gray of unimportance, containing a volume exactly the right size to give the impression that everything necessary was right here.

He saw the Thinker.

"The dream," said Max—the Max'ness that was present there.

But it was different now. There was a third presence—a something. Max couldn't—wouldn't—look at it.

"You have doubts," said the Thinker.

Max said nothing. The clarity of the dream was painful; he looked at the Thinker, and saw the statue-form as a guise—its guiding force was a swirl without form, a miasma not quite real. Max felt in some way threatened by this force.

"Your certainties are shaking. You try to hold them firm—but you will only destroy yourself. Bend, don't break. Accept your lack of understanding."

"No," chimed the something. *It's nature, unlike the Thinker's, was definite—firm, evident, easily observed. But Max couldn't make himself observe it. "If the truth is abandoned, there is no acceptance. There is only nothingness. That which is, always is."*

Max was trapped between them. The two forces argued, intransigent, repeating themselves. And with each flareup, the flux of conflict sleeted through the Maxness—building up in him a pain beyond sensation. He screamed off torment, anguish, suffering—only to be immersed again. The content of the argument was forgotten—there was only pain—

Her look was serene, patient, knowledgeable, curious. And deadly!

He fell out of bed. He came awake with a pounding head, terrified.

"Max?" Brenda mumbled blearily.

From what he could remember, it hadn't been all that terrible—just the Thinker again, and something else, talking back and forth. But it left him scared stiff—he'd never been so scared, not even during the shellings off the Mekong Delta. And his head—it hurt just to blink.

He hauled himself up—red flashed before his eyes. He stumbled into the bathroom, braced himself against the sink. "Aspirin," he rasped.

"Max, wha's wrong?" Brenda, sleep-fogged, staggered up beside him.

"Nightmare," his voice shook, "headache."

She woke up a little more. "A nightmare?"

Max dragged up a hand, opened the medicine chest. "Aspirin!"

"Here," she said, reaching for him. He grabbed it from her, snapped the lid. The contents flew at his other hand; four pills made it to his mouth.

"Max, what's wrong?" she gasped.

He waved her off, gulping water. He pushed past her to the door, stumbled towards the bed.

"Is it something I did?" her voice rose.

He crawled across the bed. *No. Don't sleep. No more dreams.* He got off, grabbed his clothes. Head still booming, heart jamming sternum. Get out.

"Max! Why can't you *tell* me?"

Find Stephanie. You need her. She'll make it all right. The vision of his mate became a chunk of peace in his storming mind—but the storms only heightened around her.

He ran out to the car, still holding most of his clothes. Nearly pain-blind, he drove madly through the pre-dawn gloom.

Eleven miles out of Flint, the aspirin started to catch up with him. The pain blunted. He pulled over. Before he slept, he realized that he had no idea where Stephanie was staying.

No dreams—but he woke up fuzzy, morning sun lancing into the car.

What the hell is wrong with me? A bitch I don't even know comes up to me and I want to sack her out on the spot. And I run away from the girl I love, leaving her hurt and worried. I drive like an idiot, fall asleep in the car, and probably could have been picked up by a State Trooper.

As he put on the rest of his clothes, he accepted the datum: there was something wrong with him. Now to do something about it. He was having dreams—that was a psychologist's problem. Did he want to waste money on a thing like that?

Or did he want to take what was being handed to him for free?

People were sick of news. TV was nearly all entertainment; the entire urban sweep of Detroit-Cleveland-Pittsburgh could only support one newspaper. HEW had issued a press release about the super-child experiments; it went almost unnoticed. Max hadn't been bugged once by publicity hounds. People had other worries.

Frayley was clearly elated, even over the phone. "Certainly I can see you. And would you mind if I introduce you to one of my assistants? She has some personal studies she'd like to take up with you."

Max agreed to anything, just to find out what was wrong. He entered Frayley's office an hour later—and found out who 'she' was.

"Max Kalubas, this is Adrianne Simpson. She's working in Forensic Psychology, and also Philosophy and Metaphysics."

Her skin was a warn, even medium-brown. Black hair arrowed halfway down her back; black brows arched over black eyes. She looked short—but generously curved, and roughly his age.

This, he thought, is probably the most beautiful woman I've ever met. But I'm not the least bit excited.

"Pleased to meet you, Mr. Kalubas." There was a restrained rush in her voice.

"Excuse me, Miss—" Max was still admiring her—academically.

"Ms., if you don't mind."

"Uh—if you don't mind my asking, what race are you?"

She smiled routinely. "Half black, half Polynesian. I'm from Hawaii."

Max nodded. He was fascinated by her—but in an oddly offhand way.

"Now then, Max," Frayley stated, lodging a cigar in his mouth, "you said you were having some trouble. Nightmares, or something."

Haltingly—not used to crying on shoulders—Max worked out the story, sticking to the dreams and leaving out Stephanie and Brenda. Neither of the others interrupted; Frayley jotted a note once in a while.

"Well," Frayley glanced at his note pad, "it appears that you're having trouble accepting the idea of a super-child in the family. The changes it would bring about. This seems to be the dominant point of the 'conflict'. The project has brought this on."

"Yeah," Max conceded. The timing was too good.

"And if you realize that you need help," Frayley went on, "you can be helped. That's a big step. Would you like me to schedule some regular sessions?"

"Excuse me," Ms. Simpson broke in, "Mr. Kalubas, would you mind very much if I hypnotized you?"

Max shot her a surprised look. "Huh?"

"It'd take a while to explain—maybe forever. But it has to do with my work on the nature of thought."

"She's a good hypnotist," Frayley inserted.

Suddenly, Max found Adrianne Simpson repulsive. An egghead, a hypnotist, a woman's-libber—yes, a Negro. "Lady, you're freaky!"

Her look was serene, patient, knowledgeable, curious. *And deadly.* "I can't make you do something against your nature."

"Listen, I don't know what kinda kook you are," Max backed his chair, getting up, "but I'm not playing along." His pulse raced—he had to get away, mustn't let them trap him.

"Well, if you'd rather not," she shrugged.

Find Stephanie.

He blanked. He must have gone out and started running, got to his car. He came around at a stoplight, winded and sweating.

Okay, that seems to be the only way to make any headway. Find Stephanie. I guess I ought to admit what's obvious—I love her, and I'll crack up if I don't have her.

There, that was a reasonably clear interpretation. He decided to stick with it—and he *did* want her more every second.

He grabbed Zuker in the motel lobby. "Where is she?"

"Hey, take it easy," Zuker quailed in the firm grip. "She's up in her room, strung out."

"I've got to see her!"

"Let go of me!" Zuker fleered, jerking his arms desperately. Surprised, Max let him loose.

"There," Zuker said, straightening his shirtsleeves and controlling his breath. "You better watch that stuff, Kalubas. Comin' on like a lunatic, grabbin' a guy like that."

For a second, Max realized that he must have been more aggressive than he thought. But back to business. "Where's Stephanie?"

"Up in her room, like I said."

"Which room?"

"Hey, you ain't goin' up there now."

"Why not?" he snarled.

"It ain't my fault! She's on the rag."

It took a minute for Max to understand. She was having her period. Wouldn't feel like it.

"She's just one of those broads who has it rough, these couple days," Zuker shrugged.

"Can she come out to dinner later on?"

"I dunno."

"Well, go up and ask!"

Zuker jumped, and scurried off.

Max paced on the faded carpet. Could he stand it a couple more days? Would seeing her, and not having her, just make it worse?

Zuker returned. "You can pick her up at seven."

She was dressed more conservatively than before; the dress covered her breasts and trailed to the floor. But her condition still showed—her neck was swelled slightly, her bright expression a little forced. She had worked on her hair all afternoon, so it looked fine—but her overall effect was lackluster. She looked more her age.

It didn't matter. Max struggled to keep his hands off her.

They ate at a steak house with a charcoal broiler shooting flames in the front window. He wore his rarely-used tan sport coat, and managed to look trimmer than he was.

"Stephanie."

"Yes, Max?"

Carefully, holding back, he took her hands in his. "I'm going to be very honest with you. Maybe offensive, but truthful. When I saw you in the airport, I flipped. No other woman means anything to me—not even the girl I'm engaged to."

"W-well," she kindled, "I'm—happy to hear that!"

"And I feel—" sweat warmed his palms, "—very *physical* towards you. I—can't explain it, but—but I just can't wait until, uh—"

"Four days," she breathed.

"Four?"

She glowed. "That'll be my time of maximum fertility. And right now there's nothing I want more—" she slid a hand to his face, and said the rest without words.

He swallowed. It was more than he could stand. "But—four days!"

"I'm yours," she said, "let that be your comfort."

From infinity: "Son, can I talk to you a second?"

Max looked up—and saw his father.

Stanley Kalubas stood straight and stern. Definitely not smiling. Lifetime reflexes brought Max to his feet, sparked fear in him. "Is—somethin' wrong, Dad?"

"Brenda just called me," the elder said gravely, "the poor kid wants to slash her wrists. She can't understand what's happened to you—last night, and now."

Max's ardor withered before the parental strength. "Brenda—she—I just don't make it with her—"

"What kind of man are you?" his father intensified, "leaving a sweet girl like Brenda stranded? You're going to marry her!"

"No!" Stephanie whirled up between them. "Max, you can't make him understand. This is something only we two can know. Together. You just have to forget this Brenda."

Unease welled up in the back of Max's mind. This argument—it mustn't happen.

"I don't know what's gotten into you," his father grated, "but I do know what you're going to do—"

—a shudder ran through Max's knees—

"—you're going to go back to Brenda right now and apologize—"

—his neck jerked, prickling; there was something threatening—

"—and beg her to forgive you, and take you back!"

—the unease in his head coiled into pain—

"Who are you going to listen to?" Stephanie retaliated, "your own feelings, or someone else's idea of what's right?—"

—his heart ricocheted in his chest—

"—You know how you feel about me. How we feel about each other—"

—he felt his feet push the floor. *Away. Safety.* The pressure, the conflict, he couldn't stand it. Flailing at the syrup air, must go faster. A dark shape coming from one side. Get to car, can move in car, escape. Something brushing his arms and shoulders, noises: "—wait, where are you going? Please listen—." Crack elbow against swinging double doors, shake off hands. Car. Car.

He sat still against the seat. Something was missing. He had been running out of the restaurant—now the car was stopped, parked by a gas station, and he had a headache. One like he'd had after his dreams.

"Are you okay?"

He jerked. On the seat beside him was—"Who the hell—?"

She leaned forward out of shadow, into the sharp glare of the gas station lights. "Adrianne Simpson. From Dr. Frayley's office, remember?"

Momentarily he forgot his disorientation and headache. "How did you get here?"

"I was at the steak house, watching you. I tried to stop you when you ran out—but you just shook me off, as if you couldn't see me. You didn't notice when I jumped in the car with you. It was a scary ride, believe me."

A new voice, heavily inflected: "Is he well?"

Max squirmed jerkily to look out the window. Facing him was a shadow-shrouded face topped by black hair gleaming slickly in the harsh light. "Who—?"

"Pardon, please," said the voice, queerly tongue-fluttered, "I am work to this petrol station."

"He's all right now," Adrianne said coolly. The man outside nodded quickly, then trotted back to the station.

"What wazzat, a Hindu or something?" Max asked thickly.

"Iraqi. He helped you park the car a minute ago—and you don't remember. We both had to talk you out of starting up again."

Max watched the attendant return to work—toiling in the busy cave of light, laboring for the motorists emerging from darkness. Holding down his own piece of importance, pumping gas when needed.

Max visualized all the thousands of Asian immigrants, taking over the substrata of society—and thus getting the means to influence the surface. In twenty to fifty years, he thought with a shudder, they'll have squeezed us out—everything'll be entirely different, just because they're here. So new and strange . . .

New and strange . . .

Newness and strangeness. Here, he seemed to realize, was the source of all his trouble. He had no idea why.

He fingered his temples—then remembered his passenger. "What do you want?"

"I want to hypnotize you."

The full memory came to him. This woman was dangerous. "Get outta here!"

"Listen to me. There's something very, very wrong with you—you admitted as much to Dr. Frayley. When I saw you at the steak house, I knew there was evidence of my theories here."

"Theories? Evidence? Whaddya talkin' about?" He shoved away from her, digging his back into the window crank.

She brushed hair away from her beautiful, ominous face. "I'm talking about helping you. If what I suspect is true, I'll be able to tell you why these last few days have been so horrible for you." She had something in her hand. It caught the light from the gas station, bounced it, flashed it . . .

"You want to know," her voice assumed a monotone, somehow in resonance with his very being. He couldn't move. "You want to find out as much as I do. More. More." The glow in her hand grew, softened, spread . . .

You're going to meet them. Relax. The Max-ness hesitated. "No. They come, and it hurts. Pain and fear. I don't want them to come."

You can face them. You are Max. You are the maximum.

The Thinker was there.

"The pain will go. You need only accept the not-real with the real, the elusive with the obvious. Resistance is pain."

"No." It was the presence, the *something* that argued with the Thinker. "You must return to solidity, to truth. You must have faith in what is, and not pollute yourself with fantasies."

Max, quickly. Does this argument bother you?

Max wrenched at the intrusion. "It—is painful."

Why?

"I don't know."

Is it because you aren't realizing the true nature of this conflict?

"What do you mean?"

What—or who—is the 'something'?

Max didn't answer. He didn't want to know.

You hear—and remember—the argument only in the way you can accept it. You don't remember the real content, the actual words and feelings. And you have made these disguises, because you can't accept what the two forces really are. You nearly saw through the Thinker before, but its nature is beyond your present understanding. But you refuse to look at the 'something'—because subconsciously you already know who that is! See him now.

"No."

It will stop the pain. It will overcome the pain for you.

The Thinker was silent. The *something* was silent.

"You can silence them?"

Yes. And you can overcome them. If you know them.

"Yes."

See the 'something'. Call it forth.

The Max-ness approached the *something*. He saw it, admitted it to his awareness.

It was his father.

He sat on a lawn chair in the refreshment area of the gas station, watching moths flickering about the fluorescent tubes. He ran a hand through his sparse hair. "Talk. I'll listen."

"It's a direct conflict between your father and your son-to-be. Parents and children-to-be, really, but the males carry the brunt of the battle. Dominant chromosomes. You can visualize it if you look at each person as one point in a complex, multi-dimensional structure—his place, and thus his being, affected both by parents *and* unborn descendants. There's still so little known about the metaphysics of genetics—causality could go in all directions."

"I don't get it." And he wanted to get it.

"I don't either, really," she sighed, "but my theory is this. The survival instinct is more than something carried on from ancestors—it's maintained by unborn descendants, advanced enough from humanity to reach their mental influence back in time to aid their bumbling, primitive ancestors. Us. They have a vested interest in our survival—they want to be born. This assumes a very delicate theory of time, and states that not only is there an ancestral memory, but a two-way flow of it through time."

Max was lost. "You mean—these guys have already been born, in the future, but have to keep us alive so they, uh, won't stop having been born?"

"English verb construction can't handle a concept like this," she smirked at his tied tongue. "Besides, I've modified my theory. Your father is what he is—a proud, hard-headed, insecure person. This nature, living on in you, is like a part of him—an ancestral personality, which you've solidified over the years by knowing him. Your vision of your father is an extension of him; he is able to exert himself on you this way. This makes as much sense as the idea of discipline, or anything involving the concept we call thought.

"Just think of a mind so perfectly in tune with the universe that it could wipe out the Earth at a whim!"

"However, you aren't your father. You could, presumably, give issue to a super-child. A child so terribly powerful that its *potential* existence is enough to bring it to life within you, creating a descendential personality, to coin a phrase. The potential, or probability, is real—just as matter is 'solid,' by the probable presence of its particles. That gets into quantum mechanics and Heisenberg uncertainty—no, never mind.

"This potential personality also existed in Mrs. Weidrich—and got a stronger hold on her. Your child-to-be tried to unite you—and had to control both of you, in order to be born. But your father—his extension within you—couldn't stand this other being's attempts to control you. You're his son. They fought a war, and you were the battleground."

He stared, sag-cheeked, at her. "Is it over?"

"Probably not," she admitted, "it isn't a simple, linear thing. The personality-forces exist inside you; they're too much a part of you to disappear."

Max shuddered. His muscles tensed involuntarily, as if to prevent him from plunging through the yawning voids separating ghostly atoms. Walls crumbled, floors dissolved. He wasn't losing touch with reality—reality itself was faltering. "If they're so much a part of me," he said carefully, "if they can control me—can *I* control me? How do I know when I'm in charge, or when one of the others is? Are they parts of me, or am I a part of them?" His lips trembled, as if about to utter the magic words that would destroy the universe. "Do *I* exist at all?"

"That's a gut-deep question," Adrianne said gently, "so you have to answer it yourself, if it can be answered at all."

Max lapsed into a tortuous silence, deluged by concepts, horrified by implications. His pragmatism was sundered; he was reduced to fearing for the presence of an immutable identity that was Max Kalubas.

But gradually he was sidetracked. His heart kept beating, his lungs still pulled air, his scalp still conspired to throw off his hair. Slowly he drew away from the precipice, having reason to believe that the cosmos was intact. And he—whoever, whatever he was—continued to function. Now he knew—sort of—what was going on. And this awareness was enough to be considered a separate iota—a viewpoint—that was his alone. Yes, he existed, he just hadn't known about all the stuff going on behind his back. Eagerly he assembled more and more anthropomorphic rationales—anything to believe in. He existed. He did, he did.

"How do you feel?" Simpson asked delicately.

"All right, I guess." He built up a structure of pragmatism. The moving parts went into action. He left oblivion far behind.

"Then you know where you stand?"

"Uh huh."

"Then, please, do something for me."

He looked at her, surprised. His egocentric rebirth wasn't entirely ready to accept another person, another's needs.

"You don't want a super-child," she knelt down, touched his knee. "Anything with a potential existence strong enough to be observed would be a terror. I don't want to live, thinking such a being could exist. God knows what it could do."

"Yeah, I know." He peered at her worry; she was supposed to be serene, all-knowing. But below the surface, she was shook.

"The only sure way is to kill you. I'd do it, if I thought I had to. But I know you realize the problem. Don't let this child be born!"

"Don't worry." He stood up, thinking: *she's honest-to-God flipped!* "I know what I'm up against, now. I'm marrying Brenda. And I'll be a good husband."

Simpson smiled crookedly. "I'm glad. You don't know what it means. Sometimes, knowing what I know—" Her breath was quickening. She wheeled and dashed away.

It took three days. The dreams were vivid, scary ultimatums from forces within him. But slowly he built up a tolerance—and abandoned the distinctions that only made things worse. He couldn't draw solid lines between himself, his father, and his son—so he made himself accept the overlappings. Three days gave him enough instinctive, nonquantitative faith in himself to take over his own life again.

Stephanie cried at his sudden rebuffs. She clutched at him with a ferocity that surprised even Zuker.

"Why?" she shrieked, "after you were so willing—why?" There was a fire in her eyes that sought the same fire in his.

He held her back, voice even. "I'm not going to sacrifice myself to the next generation."

She withered at this; her eyes dimmed. He turned and left, laughing inwardly at Zuker's speechlessness.

"But your mother, she always wanted a nice church wedding," Stanley Kalubas stammered, somehow unable to get the full attention of his suitcase-stuffing son.

"Brenda wants it simple," Max stated, "we've got it all arranged with a Justice of the Peace upstate."

"But—don't you even want your ol' Dad there?"

Max smiled politely at his father. "There are only two of us getting married."

His father sat nervously, left hand scratching right wrist. Max kept packing.

Finally, Max hauled up the two suitcases. "Dad, I don't want you to overwork while I'm gone. Just take the jobs you can handle. A man your age ought to start slowing down a little."

His father just stared at him, with a face the color of day-old bread.

In Michigan, the number one family pastime is Taking The Boat Up To The Lake. All the way upstate, Max saw a steady stream of trailer-hitched pleasure craft. It didn't matter if the boats were ever put in the water—oftentimes they stayed on the trailers while the owners painted them, drank beer, and fished from rented canoes—the northbound superhighway was festive with leisure. Max sensed Brenda on the seat next to him—a reassuring presence, a simple vessel of affection. He was genuinely relaxing, for the first time in weeks—she seemed to drain him of all care.

The next two weeks, at a modest lake resort near Traverse City, were heaven for him. He had no nightmares. This actually bothered him at first—according to Simpson, the battle still should have been going on inside him—but soon he let his good fortune work for itself. With each day's laughter, with each night's caresses, he grew more and more secure in the presence of dear, sweet Brenda . . .

He was driving again. Home. Honeymoon over. For some reason, the last couple days were blurry . . .

"How do you feel?"

"Fine," came from him. Yes, he felt fine, but he didn't know he was going to say that.

"Just checking. I have to make sure."

Make sure? It didn't sound like Brenda. Too confident. Max managed to turn his head—it was her. Then again, it wasn't.

"I think you're all right. You're ready to take on family responsibilities."

Through his pleasant stupor he shoved out words. "What the hell are you talking about?"

She smiled at him. "I'm talking about a potential personality smart enough to hide its real gene configuration. One that doesn't want government supervision, or any public awareness of its existence."

He saw sweat on his knuckles, knotted on the steering wheel.

"I'm glad you got out of that one match-up—but I could have helped, if I'd had to. They thought they had a super-child potential before. But *now*—" She chortled. "Actually, there's no need for the term 'potential' any more. Just think of a mind so perfectly in tune with the universe that it could wipe out the Earth at a whim."

There was a bridge ahead. Good, solid concrete pylons. His tongue scraped his lips.

"And we don't have any silly suspense, either. It's a girl."

His wrists tensed. A quick jerk, that's all—

She squeezed his arm. "And you'll be a *good* father, won't you?"

The bridge raced at them. His fingers were firm in the notches of the wheel. He wanted to, he really wanted to.

He saw the bridge shrinking in the rear view mirror as the pleasant, affectionate fog thickened in him again. ○

GEOTHERMAL POWER

from page 87

now planned are working, the total production of The Geysers will be about 480 megawatts, or the current drain of the whole San Francisco Bay area.

Geologist Dr. Robert Rex, of the University of California at Riverside, has estimated that the eventual solution of geothermal plant design and operation difficulties will allow the Imperial Valley and The Geysers steam fields to generate up to twenty per cent of all U.S. electrical demands. And when every potential site in the eight other states known to possess geothermal activity is thoroughly explored and the fields tapped, that figure could rise to fifty percent and possibly more, all without building another boiler or reactor.

Several interlocking factors now are preventing that goal from being accomplished. First is the innate conservatism of the utility companies, who are reluctant to fund research into new electrical generation methods so long as their coal and gas-fired plants are economically viable. And when thought *is* given to change, the incentive to switch is usually directed towards nuclear power plants, which, though they have lost much of the prestige and glamour they enjoyed in the 1960s, are still heavily subsidized and underwritten by the Atomic Energy Commission.

Apart from those considerations, geologists and engineers are divided as to how long a typical field can continue to supply steam to a generating station like the Union Oil's plant at The Geysers. Even employing a closed-cycle system like Van Huisen's "Downhole Heat Exchanger" is no guarantee that a field will last forever, and determining the lifetime expectancy is vital when attempting to convince utilities to invest in something that, at first glance, looks suspiciously like perpetual motion. A United Nations conference on geothermal energy was held in Pisa, Italy several years ago, and Dr. Joseph Barnea of the U.N.'s resources and transportation division set the average field life at thirty years, "for purposes of estimating the amortization of the investment used in developing it."

The lifetime of a field can be extended with a technique known as reinjection. This is nothing more than forcing water back into the magma reservoirs; simple in theory but far more difficult in practice, reinjection involved some rather fierce engineering problems that only now are being solved. A Mexican geothermal plant at Cerro Prieto, just south of the Imperial Valley has been experimenting with reinjection both to replenish the magma reservoir waters, and also to control ground subsidence caused by extensive pumping.

Geothermal power may not be the ultimate answer to man's energy problems, but it's an energy source, and any available energy source must be developed just to enable our high technology civilization to continue to function until more perfect energy sources are developed.

So far, reinjection of fresh water or brines has been limited in application, for the process carries with it a possible danger. Evidence exists to indicate that water fired into the crustal rocks tends to "grease" the tectonic faults that lace the strata in geothermal regions, and the result could be rock slippage, or earthquakes. In the mid-1960s, the city of Denver suffered hundreds of small tremors when the Army began flushing chemical wastes down wells beneath the nearby Rocky Mountain Arsenal. The 'quakes ceased only when the Army was persuaded to suspend its activities.

An M.I.T. study group, though, recently arrived at contradictory data, suggesting that water reinjection may work to prevent earthquakes. The geologists admitted that while water-lubricated fault lines do slip and cause minor tremors, reinjection keeps the lines from sticking and allowing the pressure to rise to the intolerable levels that make a major rock movement a certainty.

Further research and on-site experimentation will eventually settle the controversy now surrounding the reinjection technique, adding impetus to what Dr. Barnea described as the "beginning of a breakthrough" in the use of geothermal energies. Following the Pisan conference the U.N. gave its full support to geothermal power generating, deciding that it is eminently suitable for the many Middle Eastern, Asian and South American nations which currently lack either hydrocarbon fuel supplies or the massive technological and economic investment necessary for nuclear fission power stations. Taiwan, Chile, El Salvador, France, Hungary, the Philippines, Turkey and Yogoslavia now are constructing pioneer geothermal plants—most with some degree of U.N. aid or technical assistance. A dozen more are exploring possible field sites, and for the smaller nations this represents a considerable act of faith in geothermal energy as well as cash; even boring a single test well costs over $250,000, with no guarantee that a steam field will be tapped.

Something of this spirit is starting to emerge in the US government, albeit slowly. In 1970, Congress passed the Geothermal Steam Act, establishing it as a worthwhile national objective and worthy of federal support. Since adoption the Act has encouraged several agencies, including the Department of the Interior, the Bureau of Reclamation and the Atomic Energy Commission, to establish geothermal research projects. These studies range from prosaic detailings of brine removal processes to an AEC proposal to "make" geothermal fields with low-yield atomic charges detonated to form caverns in hot but dry rock stratas. Part of this year's three-million dollar research budget is being aimed specifically at improving the ways that geothermal energy can be detected without the high expense of well-drilling.

In turn, this will stimulate more serious consideration of applying geothermal power to meet the looming energy crisis. But even enthusiastic supporters of geothermal power admit it can never completely satisfy the demand brought on by an unchecked rise in per capita kilowatt usage coupled to an ever-expanding population. In time the need will spiral past the capabilities of geothermal plants occupying vevery possible square foot of site land and utilizing the most efficient heat extracting procedures available, such as the one developed by Allen Van Huisen.

After that point must come the hydrogen-fusion generating systems. Still far in the future, they may mark the limits of mankind's ingenuity in this field of endeavor, for controlled fusion will require the invention of a reliable, workable force field.

Until that time, powerplants run by geothermal steam will be stretching to meet the needs, as one-by-one the antiquated oil and coal operations fail for lack of fuels. Over the coming decades geothermal energy may seem even more than a natural remedy to some of the industrial ills that beset us, gradually assuming a reputation as an absolute cure-all for which it was not intended. But that development, however characteristic of human nature it may seem, will be incidental; most people will be glad if the lights stay lit and we are all kept, in our lifetimes, out of the Black Gang. ○

SUPER CIVILIZATION

from page 53

types of stars and are spread evenly but thinly over the galaxy—would be far harder to detect. We must know much more about stellar and galactic evolution before we can pick out ones like this.

So it turns out that the best way to look for extraterrestrial civilizations is simply to study our galaxy in as many different ways as possible. After all, if advanced civilizations exist, it is unlikely that we can guess correctly what their artifacts look like. Far better to look at all sorts of emissions—visible light, radio, infra-red, ultra-violet, x-rays, cosmic rays and gravitational waves—to increase our knowledge of natural astrophysical processes. Then we will be equipped to pick out artificial sources.

Of course, intelligence doesn't necessarily imply a highly technological society. Quite possibly most alien races in our galaxy have no technology, while others may have once attained it and afterward abandoned machines and their trappings. Whether we think in terms of Kardashev's classification—which essentially equates kilowatts consumed per person with advancement—or in Dyson's view of civilization driven by a ceaseless need for expansion, *all these are just linear extensions of aspects of our own civilization.* It is unreasonable to place exaggerated faith in our own foresight.

In a way, the whole idea of looking for superior technology this way is comical. Aside from the fact that infra-red emission is not clear signature of intelligence, the way radio signals would be, consider the very idea of detecting civilizations by their waste heat. This sounds uncomfortably like analyzing aliens by their garbage—not a very noble way to go about it, and probably not a reliable way.

But nobility itself is another human term in a universe of totally alien societies, where there may be no social norms.

Dyson feels that if there were ever a large number of technological societies, one of them would probably have carried out a takeover of all stellar energy and become a Type III civilization. In the end, this makes him very skeptical about the existance of *any* extraterrestrial technology.

Perhaps so, and perhaps not. Linear projections of our own ideas are always risky—we may be blind in ways we do not know. Whether the continuing exploration of infra-red emitting stars ever turns up a Type II civilization or not, perhaps it is best to close with a quote from J. B. S. Haldane;

The universe is not only queerer than we suppose, but queerer than we can suppose. O

PROJECT CYCLOPS

from page 52

is that we would spend a half cent out of every ten tax dollars on the likely possibility of contacting other civilizations, most of them far in advance of us.

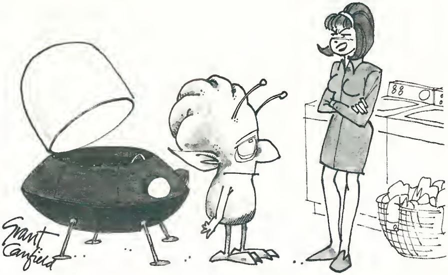
What are the chances that such an ambitious program will be funded, given the no-new-starts nature of recent science budgets? It all depends upon public interest in extraterrestrial life. As our probes gradually explore the solar system, the barrenness of our local habitat becomes apparent, at least as far as advanced life forms are concerned. The Viking landings on Mars in 1976 could be crucial to future life searches. If life is found on Mars, increased public interest in exobiology will aid the Cyclops proposal. If not, it will take large efforts to persuade legislators to spend anything on such a long timescale effort. The crucial factor is public interest. Will the prospect fire the imagination in this era when so many technological feats do not?

After all, what could we learn from such signals? In this case, the medium carries a message of its own. Consider: from the periodic nature to the Doppler shift, we could deduce the length of their day and year. From observing their star we could deduce its mass. Simple Newtonian dynamics then tells us how far away from their sun they are and therefore an approximate surface temperature for their planet. That would give us some idea of the possibilities for their biology.

But the real meat of the message would be the wealth of information about a people more advanced than ourselves. Some signals would be simple codes, clearly identifiable facts about their home system biology. There could also be instructions on what other frequencies they are broadcasting on. These other channels would contain primers on their communication language, followed by their science, religion, social systems, new esthetic forms, subjects we have yet to even conceive. Perhaps we could learn something which would bypass our present insanities and allow us to survive longer as a race. It would mean the final end of man's cultural isolation.

Still, beyond all of this is the fundamen-

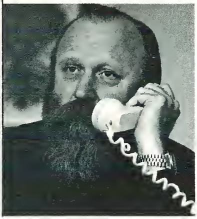
Still, beyond all of this is the fundamental reason for man's exploration and ration of the fifteenth and sixteenth centuries, we have spread over this planet, searching every cranny. What are we really looking for? A psychologist would say we are pursuing outwardly that internal search to make ourselves whole. And a mystic would point out that we are the highest local example of the universal tendency for increasing structure in matter, the universe exploring to become conscious of itself. We have become what we are because we possess the means of communication between each other. It enables us to both unite against our common problems and to make the person-to-person contacts which we prize above all things. Communication is our future and Project Cyclops has shown us our next step. O



"Are you really from the fifth planet of a G-type star—or are you here to get my laundry dazzling bright?"

FRANK HERBERT

from page 37



does help, and it points in very interesting directions. It points in relativistic directions. It says that we have the imagination for these other opportunities, these other choices. We tend to tie ourselves down to limited choices. We say, "Well, the only answer is. . . ." Or, "If you would just. . . ." Whatever follows these two statements narrows the choices down right there. It gets the vision right down close to the ground so that you don't see anything happening outside. Humans tend not to see over a long range. Now we are required, in these generations, to have a longer range view of what we inflict on the world around us. This is where, I think, science fiction is helping. I don't think that the mere writing of such a book as *Brave New World* or *1984* prevents those things which are portrayed in those books from happening. But I do think they alert us to that possibility and make that possibility less likely. They make us aware that we may be going in that direction. We may be contriving a strictly controlled police culture.

B. F. Skinner worries the hell out of me. He is right out of Huxley. He is standing there like a small boy saying, "Please let me have a world like this because *I* feel safe in it!" He is saying, "I want to control it." He may be very accurate in his assessment that our total society is going in that direction and that maybe he is opting for the lesser of numerous evils, in *his* view. But what kind of a society would that produce?

VERTEX: We'd like to touch on some of the personal aspects of your life. You mentioned earlier that some of your hobbies included electronics. What are some of the other things that you do for recreation?

HERBERT: I like to do cabinetry; I like to do things with my hands when I'm not writing. I feel that I'm getting as far away as I conveniently can from the activity of sitting at a typewriter and putting words on paper by doing these other things. It's helpful to me; it's a kind of a catharsis.

I garden. I have six and a half acres in the northeast corner of the Olympic peninsula in the state of Washington. I am in the process of developing what, I hope, will be a demonstration plot of land in which the demonstration will be that one can live a relatively high quality of life without an enormous, irreplaceable energy drain. I am going to do some hand work on the land. I shovel dirt and move rocks. I am in the process of creating a very small lake/pond/marsh combinadion by staggering the depth of it. I am going to plant wild rice and a new upland rice which has been developed for high altitude use in the Phillipine Islands. I am not one of those people who believes in the "hot" gospel of ecology that man should keep his hands off the land. I believe that when he changes the land he ought to do it with an eye to the future, and with a little loving care so that when he has finished changing the land something is there that is more sustaining than what was there before. I will be able to plant trout in this pond and frogs and that sort of thing. It will attract birds that feed on the rice. That's why I'm planting it there. I'm going to build a kind of meeting house there—a guest house for friends to come in and have seminars and that sort of thing so that we can rap and exchange ideas. I hope to build it out of stabilized adobe, which is a very fine insulating material. As I dig the adobe out of the ground it will provide me with a basement in this guest house. Some of the land we scoop back for this lake-cum-pond will also provide us with adobe. I felt I had to put my hands where my mouth wa. I was going around speaking about these things and it's one thing to say, "We *ought* to be doing," and it's another thing to just go ahead and do it and say, "Well, this is the way I think we ought to do it and here is the example. I wasn't right about this aspect of it. I found that to do this particular thing my original approach had to be modified this way." This is what we always find out when we get our hands dirty. The element of doing it always teaches us much more. That is one of the hangups of education.

You wanted to know more about my personal life—I've been teaching at the University of Washington up until the last quarter. Now I've taken a two year leave.

VERTEX: What courses were you teaching?

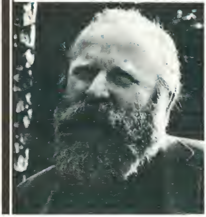
HERBERT: I was teaching a lecture course called Utopia/Dystopia, which was an examination of the myth of the better life; how we carry it in our heads. We don't do anything without resorting to this myth: growing hair on our faces, our choice of friends, the clothing we wear, the kind of government we choose, who we say is the best leader, who we say is a bad leader. We don't go into a voting booth without taking this myth with us.

VERTEX: Have you developed the course materials for this?

HERBERT: I developed the course materials. It struck me that academe is far gone down this long road of "education can be done with power." Now, all of academe is not down there. We have many, many beautiful people in education who manage to work in spite of the administrative power intrusions. But when you come right down to it, a school is a "person" who has information which works. *He* can demonstrate that it works and it is *people* who want to do what this *person* does. They want to learn how to make things work that way.

VERTEX: Do you enjoy teaching this course?

HERBERT: I enjoy it. I teach it on the basis of pass/fail. I have to grade for the system, but I give everybody an 'A'. Grading intrudes on education. It's quite obvious that we are an unique and different species. That being a sexually reproduced species, we are not all equal. Not in our abilities, our desires, or anything else. Each of us is one-of-a-kind. This happens in a class too. There are people with certain capabilities in one direction which, if you developed a measuring system in that direction, you could say are better than others; but this effectively blocks what you can learn from everyone in the class. Class ought to be a place where teachers learn too. I have what I think is a very effective way of measuring whether people are getting anything that I have to give in a class situation, *"I am not one of those people who believes in the "hot" gospel of ecology that man should keep hands off."*



and that's whether I'm getting anything from them. If I'm learning from them I know they're learning from me. Now, I am not saying by this that we should immediately start medical students on a pass/fail system. Don't read me wrong on this. We have developed a set of parameters for a certain thing. But, we ought to recognize what we're doing, how we have developed those parameters, and how tightly we constrict them so that the end products are supposed to be stamped out the same. Really, this effectively stops development. Somewhere down the line, you have to have a man who can do something that others cannot do and can demonstrate this capability. He will say, "What I can do is this. . . ."

VERTEX: He would be transferring that information.

HERBERT: Yes. "Here's how I do it." Now, obviously, this might not be the only way to do it for all time. It may not be the best way. We may develop *far* more effective ways of doing these things. But, under a power-oriented society, power adheres to people who have knowledge of how a thing works, no matter how temporary that "working" may be.

VERTEX: And the power seldom goes away afterwards.

HERBERT: Well, yes. Power tends to attract power, so that it effectively constricts avenues of development.

VERTEX: What would be a way out of that? How could you widen those avenues of development?

HERBERT: Well, if you're not to go to a completely chaotic society, with all the problems inherent in that, and that's not *the* answer, then we need ways that test the most outrageous concepts.

VERTEX: Do you have any idea how that can be done?

HERBERT: It was done under so-called "primitive" conditions by several avenues. The hermit could go out and do his thing. But we're running out of hermit space. The man with an idea that if you cut sections off a log and put a limb through the middle of them and put a load on the limb—you could carry a heavier load, drag it anyway, roll it—that man could just go do it. But our total society has found that if you let the physicists, say, build their wheel and cut their logs—then the resultant product becomes something that is used in a power context and, eventually, maybe a war. Eventually, maybe the destruction of the total planet. In this respect, I'm not as much worried by atomic weapons as I am by the whole structure and how it uses the products which accumulate in it. Far more dangerous to world society, in terms of springing upon us from an unknown corner, is the ability of a chemist and a pharmacist working in a basement, say, in South Africa to produce a mutated disease that would spread like wildfire throughout the world. Very cheap. . . .

VERTEX: Just like the old science fiction stories.

HERBERT: It's very real, and a real potential in our world today.

VERTEX: We're really kind of living in a science fiction world today, aren't we?

HERBERT: Yes. I see this very clearly, that all of these things are accumulating around us. There are developments in several fields. There's no way to control these, no effective way to channel them and stop them in terms of present social directives, such as governments and social arbiters. There is no way, for example, to prevent the pharmacist or chemist from working in that basement in South Africa.

VERTEX: That's true. Well, don't we really have to find ways to do that in order to survive?

HERBERT: I think we are going at it in the wrong direction. We're thinking of controlling it rather than having a world society where people just don't want to do that sort of thing, don't want to destroy their fellows.

VERTEX: If we could learn how to do that we would have most of our problems solved.

HERBERT: It's not *the* answer and it's not an easy thing. Part of it is in recognizing the essential humanity, that all other humans are like me in some way. You know, when you come right down to it, a society defines that word, human. We think we know what a human being is. I begin the class by having them define human. I don't say homo sapiens, I don't say I want a medical definition, a physical definition, or anything else. I just say, define it. And, with a little gentle nudging here and there, we come to my assumption, which is that most societies define human as "like me." If they are sufficiently like me I'll let my daughter marry one. If they are not like me, they are somehow not quite human. They're gooks, or niggers, or wops, or chinks. You know, everybody knows, they're not human . . . not quite. Or they're dirty Indians, or mixed. All you have to do is look at them to see they're not like me. They don't feel things the way I do. So that, if it's necessary, for some reason that *I* define, to kill off a few of them, well, the world hasn't lost much.

VERTEX: Those are hard basic assumptions to overcome.

HERBERT: Right. They are very hard basic assumptions to overcome, because they are ground into our tribal ancestry and they go so far as, say, a person who works for AT&T and has really "bought it" knows that he is better than somebody who works for US Steel. The guy from US Steel, of course, is just a little less than human, thereby.

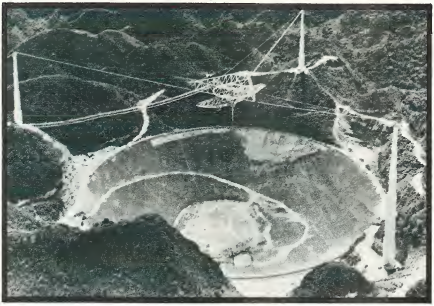
VERTEX: There are a great many people out there who respect your writings, Mr. Herbert, and your abilities. Would you like to say something to them? . . . to all the young people, especially.

HERBERT: Yes. I would like to tell them to be very careful about finding scapegoats. Technology is not a thing out there to be destroyed, thereby solving all our problems. How far back do we cut it? Do we go back to hand saws and hand axes? Which elements of the technology will we discard? I would say to let their imaginations run free. Go ahead, try to imagine things that would be fun and humorous and whatever, things that would be interesting to make. Do it with an eye to how many ripples these things will create and who those ripples may inundate. Eventually, you have to sing for your supper.

VERTEX: Thank you very much, Mr. Herbert. ○

RADIO ASTRONOMY TODAY

from page 47



The 1,000 foot diameter fixed-dish radar-radio antenna in a natural bowl near Arecibo, Puerto Rico.

arrays have been built so that the individual units can be turned or tilted in unison to point in various directions, but most are immovably fixed and can look only where the spinning earth points them.

In recent years the biggest problem faced by the optical astronomer has been the encroachment of urban life on the territory of the observatory, with the attendent encroachment of night lights and air pollution to hinder his all-important optical viewing. This is not a problem to the radio astronomer, a fact which helped in the development of radio astronomy as a major branch of the science, but the radio astronomers are still bothered by the march of technological civilization—as radio intereference and noise block the ultra-faint radio signals from the sky.

It took a long, and hard-fought, series of international conferences to accomplish anything, but eventually the radio astronomers got the various nations of the earth to keep commercial transmissions, and usually even military transmissions, off the wavelengths most useful for studying the sky. But even so, radio noise, both man-made and the hiss and pop of everything from thunderstorms to the northern lights, often masks the dim star-born radio signals, and the astronomers have had to develop amplifiers which are capable of multiplying signal strengths fantastically without distorting them, then computers to remove all the noise, static, and the occasional human transmission which escapes onto the scientific wavelengths.

While unwanted noise is a major problem to radio astronomers, it is nothing to the built-in problem that radio astronomy has had—how to pinpoint exactly where the radio source they are listening to is at in the sky. It is easy to record the amplitude of the radio signals, and even the general direction they are coming from, but since radio waves, at least the radio waves that can get through our atmosphere, are from a thousand to a hundred-million times as long as the waves of visible light, the energy collecting surfaces of the radio telescopes have to be correspondingly large to get the pinpoint accuracy an optical telescope gets. To be able to tell the difference between two close-together radio sources of approximately the same wavelength with the accuracy of an optical telescope would take an antenna dish thousands of miles across.

Even though astronomers have not yet been able to build their thousand-mile-across antenna, a way has been discovered to make a smaller antenna, such as those we have today, as accurate as that larger antenna would be. That method is called long-baseline interferometry.

What happens is that if a single radio source is observed simultaneously, and the timing must be exact to within a couple millionths of a second, by the radiotelescopes some distance apart, and if the two signals are fed into one receiver, they alternately reinforce and dim each other, creating interference patterns. Since the pattern will show strongest when the two radiotelescopes are pointed at exactly the same spot in space, the two antenna are able to determine the exact location of that radio source with the same accuracy that would be shown by an antenna with a diameter as wide as the distance between the two antenna. This long-baseline interferometry is now being used by radiotelescopes as much as 5,000 miles apart, and by recording the signals and feeding them into a computer to get the best possible readings radioastronomers have been able to obtain incredibly accurate measurements of galaxies so far away that they cannot even be seen in the largest of the optical telescopes.

Radio astronomy has come a long way since Karl Jansky set out to find out what was causing the noise which was interfering with transoceanic radio-telephone calls. Much of our galaxy, hidden by clouds of dust from direct viewing, have been mapped in the radio spectrum. Great clouds of interstellar and even intergalactic gas have been discovered, and galaxies fleeing from us at nine-tenths the speed of light have been mapped. But even these wonders that radio astronomy has showed us are minor indeed, to what, one day, will be seen when man looks at the sky. The optical wavelengths, both those to which the eye reacts and those to which man-made films will react, are narrow indeed. The discovery that radio could be used to map the sky opened up the "window" much wider. But still, from the shortest of x-rays to the longest of radio waves, only a small percentage of the radiations striking earth from space are able to pass through earth's atmosphere. Not until we are able to build new telescopes, both radio-wave and optical, and someday even x-ray and gamma-ray, in space or on the moon, will man be able to truly map the farthest reaches the universe. O

Illustration by Monte Rogers for Kessler, *fiction by Herman Wrede— when living in the minds of others, man must be prepared to view the horrors as well as the beauty within the human brain.*

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